AMERICAN MACHINIST

JOURNAL FOR MACHINISTS, ENGINEERS, FOUNDERS, BOILER MAKERS, PATTERN MAKERS AND BLACKSMITHS.

VOL. 12, No. 46. WEEKLY. | NEW YORK, THURSDAY, NOVEMBER 14, 1889. | $2.50 per Annum. SINGLE COPIES 5 CENTS.

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Gas Blast Furnaces.

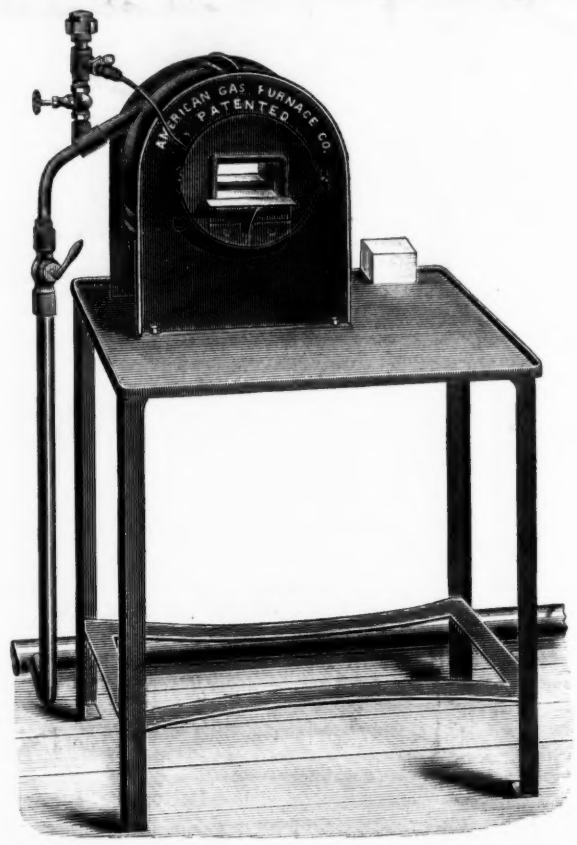
Any one at all familiar with shops and manufacturing processes appreciates the importance of having at hand some means of applying heat to steel, which is to be forged or tempered, in such a manner as will admit of its absolute control, and, as the character of the machinery used is improved, the importance of this point becomes more and more clearly appreciated. A few days ago we visited a shop near this city which is devoted to the production of furnaces adapted to widely varying uses, by which gas as a fuel is utilized, and the heat produced controlled in such a manner, applied so effectually to the work to be done, and with so little waste, either of heat or fuel, as seemed to leave little if anything to be desired.

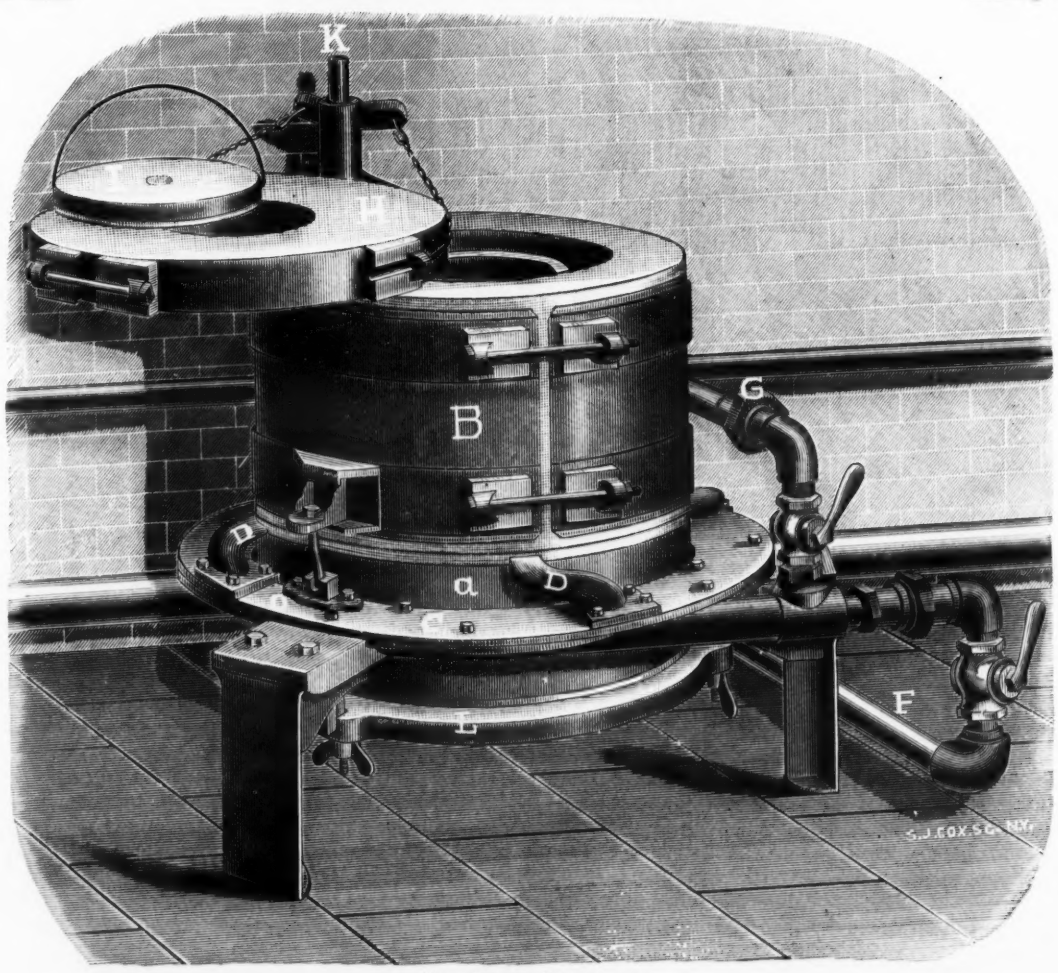
Furnaces constructed here have been for some years in use in the manufacture of jewelry, watches, watch cases; in the U. S., and many foreign assay offices and mints; bank-note engraving establishments, etc., and this has very naturally led to the designing and building of furnaces especially adapted to use in machine shops and for general manufacturing purposes other than those named. Some types of these are represented by the engravings on this and the following page.

The system employed depends upon a blast of air, which is supplied preferably from a force blast blower, such as the "Root." The gas does not pass through the blower, but is drawn in to the burner and mixed with the blast by induction, and on much the same principle as is employed in injectors. The proportions of nozzles have been fixed as a result of much experience, so as to secure the best possible results in points of effective heating and economy of gas, and means are provided whereby the relative quantities of air and gas can easily be regulated. The same general principles of construction are followed in all the furnaces shown, and the principle is most plainly shown in the engraving of the melting furnace shown on this page.

The air comes through the pipe *F*, it being preferable to take it from below, because in this way the filling of the pipes with gas when the fan temporarily stops is avoided. Gas enters through the pipe *G*, the gas and air being mixed between the junction of these two pipes and the furnace, after which it enters the distributing ring *C*, and from thence by the burners *D* to the furnace, which it enters through openings in the lining and at a tangent, so that when the gas is ignited the flames can be seen whirling rapidly around the interior of the furnace. The linings are made heavy, to secure durability, and are firmly bound together by iron bands and clamps.

The combustion chamber consists of the bottom (*a*) and the cylinder *B*, both firmly secured to the distributing ring *C*. The burners (*D*) penetrate the bottom lining, and are so made as to be easily detached and replaced when necessary. The bottom is held in position by the iron platform *L*, which is easily dropped down to replace the lining.





GAS BLAST FURNACES.

The cover *H* is attached to a sleeve, which is fitted to the standard *K* in such a manner that the sleeve can turn upon it, and as it does so is lifted by the action of cam surfaces, so that if the cover is turned either way it is lifted clear of the top of the furnace. The feed-hole in the cover is sufficiently large to admit of feeding the crucible without removing the cover, and the smaller cover *I* closes the feed hole. The crucible stands upon a conical fire-brick support, which is easily replaced, and, in case of an accident to the crucible, the metal runs out through a channel formed in the bottom of the chamber (*a*) into a drip-pan, this same channel affording an outlet for the products of combustion. If the top of the furnace be closed up tight, all the products of combustion must pass out at the bottom, and the greater heat will be concentrated there; while if more opening be left at the top the heat will be drawn upwards to a greater extent. This furnace is adapted to black lead crucibles No. 20, and consumes about 200 feet of gas per hour. An idea of its efficiency can be gained from the fact that during our visit to the factory we saw 32 pounds of pure copper melted in one of them in 28½ minutes, starting with a cold furnace, and a second charge of 30 pounds, put in after the furnace was heated, melted in 16 minutes. This was done without special effort or preparation, and the copper was thoroughly melted and poured into ingot moulds. This furnace is used for gold, silver, copper and brass, and also for making tests and smaller melts of iron, steel, glass, etc. Various sizes are made, and every part is interchangeable and easily replaced. In one of the smaller sizes (the No. 2) we saw copper melted in a crucible in 4½ minutes, starting from a cold furnace.

The gas forge shown at top of page is for use in a machine shop or other place where such heating is to be done as is usually done in an ordinary forge. The distributing ring is in a vertical instead of a horizontal position, and the flames whirl around the interior of the furnace and about the bar or other piece to be heated. Both ends may be left open as shown, as for heating in the middle of a long bar, or the back may be closed when short pieces or the end of a long bar is to be heated. A small pipe is seen leading from the gas pipe, the end of which enters the lining, and, by leaving the stop-cock in this pipe slightly open, a small jet of gas is always burning in the furnace, which serves to light it when wanted, so that it is only necessary to turn on the pressure of air and gas. The circular fire chamber is 6 inches diameter and 4 inches from front to back. The front opening is 2″x3″, the back opening 2½″x3½″. There are three burners, as in the case of the melting furnace, and they are so directed that direct contact of the flames with the work is avoided. Thus perfect combustion is steadily maintained, the work is quickly and evenly heated, and oxidation reduced to the minimum. The degree of heat is under perfect control, and can be made to suit the work in hand. We saw a ½″ square bar of iron heated to redness in 1½ minutes, and to a welding heat in 2½″ minutes. A number of differently shaped pieces of various sizes were heated, all in the most satisfactory manner, and very quickly. A number of

these forges are in use in some establishments, the names of which are familiar to our readers, and are proving entirely satisfactory.

The muffle furnaces are principally used for annealing and heating for tempering, large dies, cutters, springs, small work in boxes, or any steel work requiring a uniformity of heat without flame.

The muffle is enclosed by a fire-clay chamber conforming approximately to the shape of the muffle, which fits snugly into a recess in the front lining, and rests upon a ledge in the back lining. The back of the muffle is covered by a fire-brick slab, which fills out the back entrance, and is secured by an iron plate which presses the slab firmly against the back of the muffle by means of wing nuts.

The burner is similar to that of the melting furnace. Three burners project into a "well-hole" near its bottom horizontally, and at an angle by which a rotary motion is imparted to the flame. From this "well" the heat is forced into the space surrounding the muffle, and its equal distribution is secured by the shape of the lining.

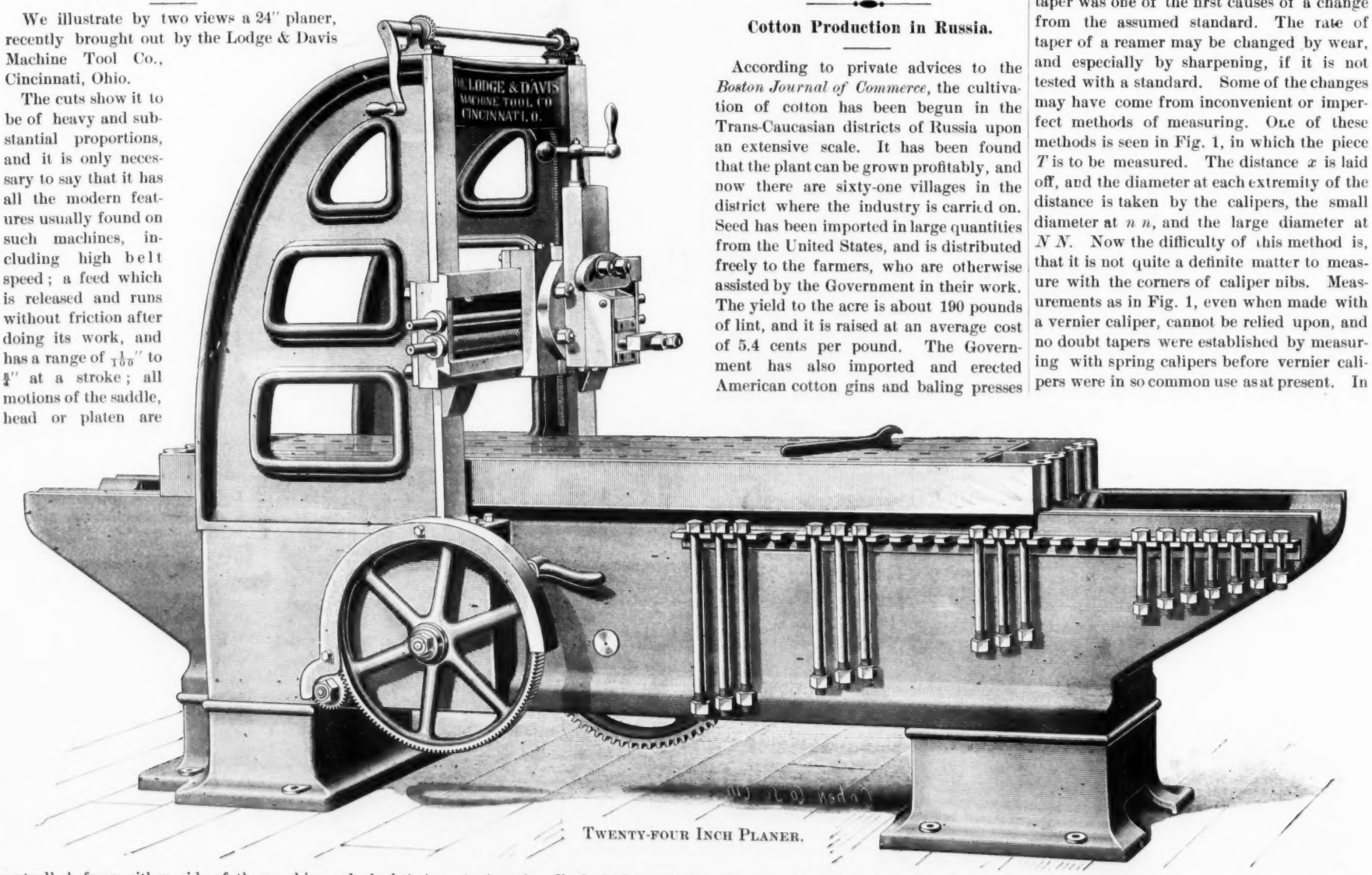
There are many different sizes, and with a variety of shaped muffles, the lining in each case being adapted to secure the best possible results from the muffle used. All that has been said as to efficiency, economy, and perfect control of the other furnaces, applies equally well to this one, of course, and tests which we have witnessed, as well as the statements of those who have them in use, demonstrate their adaptability to the uses for which they were designed. They are so made that the muffle is very easily removed and replaced. A great many other forms of furnaces are made, many of them for special purposes, by the manufacturers, the American Gas Furnace Co., 80 Nassau street, New York city.

GAS MUFFLE FURNACE.—SEE PAGE 1.

Twenty-four Inch Planer.

We illustrate by two views a 24″ planer, recently brought out by the Lodge & Davis Machine Tool Co., Cincinnati, Ohio.

The cuts show it to be of heavy and substantial proportions, and it is only necessary to say that it has all the modern features usually found on such machines, including high belt speed; a feed which is released and runs without friction after doing its work, and has a range of $\frac{1}{100}$″ to $\frac{3}{4}$″ at a stroke; all motions of the saddle, head or platen are controlled from either side of the machine, and an arrangement of dogs by which the table can be run forward for examination of work without changing position of dogs. Rollers are provided on the dogs, by which the usual friction and wear at these points are avoided. Slides of the platen are 13½″ apart from center to center, and have improved automatic oiling arrangements. Shafts are of steel, and the boxes are fitted to the bed their entire length. Each shaft, with all its appurtenances, can be taken out intact in case it is desired to take the planer apart. Holes are provided in the pockets, by means of which work of extra length may be fastened to the platen; and on the back side is a rack for keeping bolts, which will be found a convenience. The planers are built in three sizes—24″, 32″ and 38″, and with any length of bed desired.



TWENTY-FOUR INCH PLANER.

Cotton Production in Russia.

According to private advices to the *Boston Journal of Commerce*, the cultivation of cotton has been begun in the Trans-Caucasian districts of Russia upon an extensive scale. It has been found that the plant can be grown profitably, and now there are sixty-one villages in the district where the industry is carried on. Seed has been imported in large quantities from the United States, and is distributed freely to the farmers, who are otherwise assisted by the Government in their work. The yield to the acre is about 190 pounds of lint, and it is raised at an average cost of 5.4 cents per pound. The Government has also imported and erected American cotton gins and baling presses for the use of the planters, who, it is said, have agreed to deliver the cotton when harvested at a fixed price. Thirteen companies are now organized for the purpose of conducting the cultivation of cotton in this district, and warehouses are in the process of erection, in anticipation of a large business. Is it possible that American planters should have reason to fear a new competitor?

Tapers—Measurement—Soft Centers.

BY JARNO.

Would any lathe maker deliberately put ten different tapers in spindle-holes? We may not be able to tell just how such a thing as having so many tapers really did happen, yet I prefer to call it a happening, and not a purpose. There is a legend to the effect that a maker of harrows, for fear that they might be repaired by a country blacksmith, put in them half-inch bolts having *nine* threads to the inch. Gascon says that such a disturber, in order to complete his mechanical education, might well go to that mysterious country in which is everlasting summer accompanied by severe droughts. I do not quite understand Gascon's meaning; probably it is that the harrow maker should be pulverized under one of his own harrows. If there be in the world a lathe maker who would purposely add to the confusion of tapers, as did the harrow maker to the confusion of screw threads, I should say that there is at large one of Gulliver's Yahoos by inheritance, intensified by culture, and I would recommend that a missionary convert him in a converter. There are moral taints, as well as physical, that can be eradicated only by an ultimate chemical change like unto that which is made in the retort of nature.

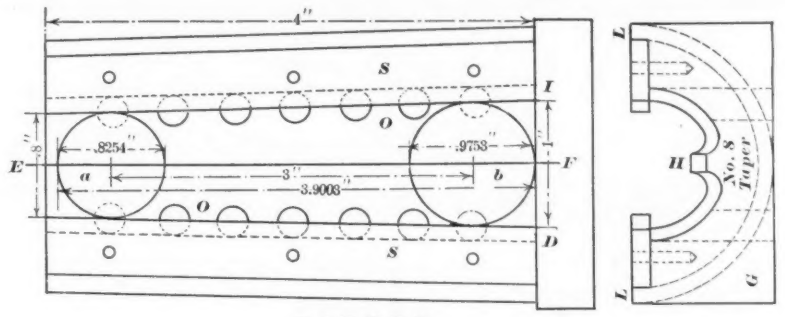
In making the supposition that the great number of tapers came not by intention, we must be expected to show how they might have come by accident. I suppose that the lack of a plug or some other gauge for the taper was one of the first causes of a change from the assumed standard. The rate of taper of a reamer may be changed by wear, and especially by sharpening, if it is not tested with a standard. Some of the changes may have come from inconvenient or imperfect methods of measuring. One of these methods is seen in Fig. 1, in which the piece T is to be measured. The distance x is laid off, and the diameter at each extremity of the distance is taken by the calipers, the small diameter at $n\ n$, and the large diameter at $N\ N$. Now the difficulty of this method is, that it is not quite a definite matter to measure with the corners of caliper nibs. Measurements as in Fig. 1, even when made with a vernier caliper, cannot be relied upon, and no doubt tapers were established by measuring with spring calipers before vernier calipers were in so common use as at present. In order to know that we are measuring accurately, at the extremities of x, it is not enough that we be guided by marks upon T; a bet-

ter way is to put a caliper guide in the tool-post of a lathe, hold *T* on the centers and move the carriage the distance *x* between two measurements. I have seen the distance between measurements laid off along one side, as at *y*, instead of along the center line *x*; this is not quite exact. A variation may have come from changes of the reamer in hardening. It is not many years since reamers were put to use almost directly from the hardening, the only sharpening being that given by a few strokes of an oil stone. Nowadays, reamers are ground, and inaccuracies from hardening need no longer exist.

An excellent gauge and an accurate method of making it may be understood from Fig. 2. The accuracy of this gauge rests upon a principle by which we can measure an angle as accurately as we can measure a diameter. Two disks *a* and *b* are made of such diameters and are placed at such a distance apart, that two straight edges, *S S*, touching each disk in two places at the same time, shall make with each other the required angle No dependence is placed upon measuring with sharp corners, as in Fig. 1, and there is the same certainty that the disks are just touched by the straight edges as there is that the disks, when being measured, are touched by the nibs of the caliper. A gauge for an angle is also a gauge for a taper. Fig. 2 is of the angle that makes the taper one in twenty, or six-tenths inch to one foot. The straight edges should be not only of the correct angle with each other, but they should also be of the right distance apart. Let us have them one inch apart at the ends *D I*. The circle *b* is of such a diameter that a straight edge *D I* that touches *b*, and is square with the center line *E F*, will also just touch the ends *D I* of the straight edges *S S* when *D I* are one inch apart. The diameters of the disks and their distance apart is shown in the figure. The gauge is for No. 8 Jarno taper, .8″ at the small end, 1″ at the large end, and 4″ deep. The body *G* has shoulders *L L*, against which the straight edges are held. The rib *H* along the middle of the gauge forms a rest for pieces that are being tested. Holes *O O* are through the body of the gauge to let in light, so that we can tell whether a piece fits. For any other size, or number of taper, the diameters of disks and their distance apart can be figured from those given in the cut, by direct proportion; that is, multiply by the number of the required taper and divide the product by eight.

In closing, I quote from Gascon, who, when he speaks, shows considerable spirit and gives some facts. One that has other qualities mingled with spirit we may like; but one that does nothing but show spirit we like to avoid. Much eagerness and little vigor may not make a good combination.

"After years of trial, I abandoned soft centers; if I were to go back to them, I should have the nightmare. While I was using them, they were trued up in their own live spindles, nearly every time that pieces were to be accurately turned. It was a close job to adjust the turning tool so as to cut at the point of the center. Oftentimes the center would try to ride on the top of the tool, and the point of the center would be thrown off to the floor. Seldom if ever did the angle of the center come right, after taking off the first chip, then one or more chips followed, at each the center becoming shorter. Often a file finish succeeded the turning—the sensation in seeing a workman file a center is very like that caused by a dentist that is filing one's tooth. After a soft center is turned, there is no certainty that it will remain true; for fear that it may be out of true, a too careful workman may turn it when it does not need to be turned. Too often have I seen a workman anxiously look at his lathe-center and then at his foreman; he was anxious because his turning tool had caught or because the dog had struck the tool-post. A soft center too easily springs out of true, being hardly stiff enough to stand the pressure of the dog in driving for a heavy chip. At last I changed to hard centers. If anything happens to a hard center, the hap is a break, which leaves no doubt in the workman's thoughts, as to what is to be done. A live center breaks no oftener than a dead center, which very seldom breaks. My live centers are now ground in their spindles by a device that is held in the tool-post, the grinding wheel being driven by a rubber roll that bears on the cone. The cone is put on its quickest speed and the back gears are in, so that the emery wheel shall turn fast and the center slowly. The centers are shaped like Fig. 3, the part *k* being turned below *l*, before hardening. Only the part *l* need be ground in the lathe spindle."



TAPERS.
Fig. 2.

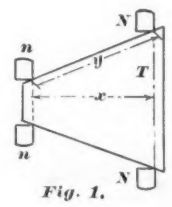


Fig. 1.

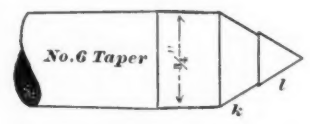


Fig. 3.

TAPERS.—SEE PAGE 2.

Classes for Practical Instruction at Boston.

Something less than a year since, we received a letter from James Duncan, Secretary of No. 1, of Boston, N. A. S. E., in regard to a night school for engineers, started in that city under the auspices of the Wells Memorial Institute. We have recently received another letter from Mr. Duncan, and as this letter tells its own story, we publish as much of it as directly relates to the subject we wish to notice. It is always a pleasure to hear of or from men who are trying to pull themselves upward in the way indicated in this letter. In these times a man who does not progress is sure to go, relatively, backward. We advise every stationary engineer who finds it possible to connect himself with a school of this kind to do so; the value of systematic study in the line of one's work cannot be overestimated. Our correspondent writes:

Last December I wrote to you giving an account of the starting of a class in steam engineering by Massachusetts Association Stationary Engineers No. 1, of Boston, with the generous assistance of the Wells Memorial Institute, who gave us the services of Professor Peabody, and whose report of the success of the experiment you will find on page 18 of the annual report of the Wells Memorial Institute which I forward to you. I recognize that a good deal of the success in regard to the number attending was due to the notice in the AMERICAN MACHINIST. Robert Treat Paine, Esq., brought the report of Professor Peabody to the notice of the trustees of the Lowell fund, and so interested them that they donated money enough to pay the professors for the classes in the enclosed circular. I must say that it was a fortunate day for us when the notice in the AMERICAN MACHINIST, of the New York class, appeared; and I am sure your interest in such educational matters will prompt you to help us now as you did then.

The circular relating to the school shows that there will be a class for carpenters, one for machinists and engineers, one for electricians and one for stationary engineers. These classes will meet on different evenings, so it appears that students may join more than one class. The circular concludes as follows:

Tickets may be obtained (free of charge) on application, on and after Nov. 4th, to Superintendent, to whom all inquiries should be addressed, at office, 987 Washington st., between 9 A. M. and 10 P. M.

Professor Peabody's report, to which reference is made, is on the whole very satisfactory as to the class of stationary engineers last winter.

It is always hard work to get ahead against popular sentiment. The managers of the proposed World's Fair in New York have, no doubt, found that out before this. With great persistency, the Site Committee stuck to their determination to use part of Central Park. The popular feeling was strongly against this; hence the work of raising the five million dollar guarantee fund has languished miserably. This is a fact that cannot be covered up by any amount of newspaper talk.

This fund ought to have been raised within forty-eight hours after the opening of the subscription books.

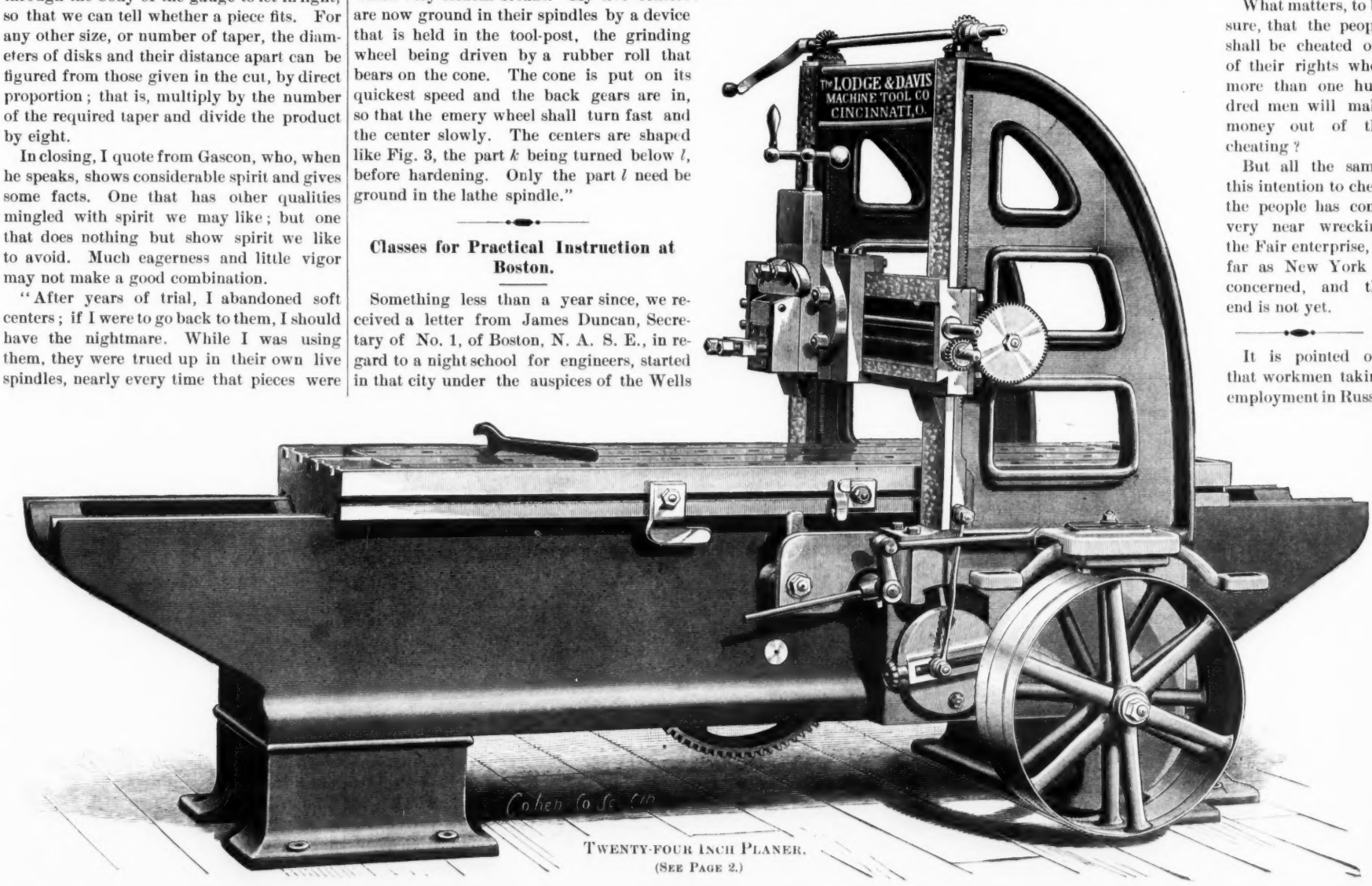
What a humiliating spectacle the frantic appeals for one-dollar subscriptions from poor working men and women to guarantee that first five millions present. And, as if this were not enough, it is plainly intimated by some of the daily papers who present this appeal, that the subscribers may never be called upon to pay their subscriptions, and that, in any event, only one-quarter of the amount will be called for at one time. All this for the first five million dollars required.

A few business men declared in favor of confiscating the people's playground. What matters, they say, a few acres of the park? Business will be increased from twenty-five to thirty-three per cent.

What matters, to be sure, that the people shall be cheated out of their rights when more than one hundred men will make money out of the cheating?

But all the same, this intention to cheat the people has come very near wrecking the Fair enterprise, so far as New York is concerned, and the end is not yet.

It is pointed out that workmen taking employment in Russia should insist on a written contract, otherwise they are likely to be unfairly dealt with, in case legal proceedings become necessary.



TWENTY-FOUR INCH PLANER.
(SEE PAGE 2.)

Hawkins' Gear Calculator.

Any one, who has been much around a machine shop, knows that, in spite of the fact that most modern lathes have gear tables accompanying them, problems relating to gears for cutting certain screws, not provided for by the tables, are continually arising, and to many these problems are somewhat bothersome, notwithstanding their simplicity.

The device which we illustrate herewith was gotten up by a shop man with the object of supplying something which every machinist could afford to keep in his tool chest or pocket, and which would instantly solve all problems relating to gears used in cutting screws—either simple or compound trains.

The instrument consists of two disks of hard firm cardboard, the smaller disk being placed on top of the larger one, and fixed in such a manner as to allow of its rotation, each disk being provided with graduations by means of which the gears required for a given screw are read off. The outer circle of the cut represents the edge of the larger disk, and is equal to it in size, the edge of the smaller disk being represented by the other heavy line. Above the word "simple" is a brass button, by which the smaller disk is rotated. The numbers 3, 4 and 5, preceded by the word "screw," stand for the number of threads per inch of the lead screw. The next row of figures (2 to 20), designated by the word "threads," stands for the number of threads per inch it is desired to cut, while the outer row from 10 to 100 represent the gears, these latter graduations being on the larger disk.

In using the device the graduation corresponding to the number of threads on the lead screw, and the one representing the number of threads to be cut, are brought fair with graduations on the outer disk, the inner disk being simply turned round until the designated graduations are observed to match.

If the lathe have 5 threads per inch, and it is desired to cut 12 threads, the smaller disk would be turned to the position shown in the cut, showing that if 20 is used for the driver, 48 (the number of the graduation which matches with the figure 12) is the number of teeth for the driven gear. If either of these gears is not at hand, the smaller disk is turned until two other graduations are matched, indicating two other gears, which will always be in the same proportion. The calculator also indicates in the position shown by the cut the gears for cutting other threads with the same lead screw (5), and driver (20).

For instance, if 11 threads were wanted, the driven gear would be 44—if 11½ threads, 46. Fractions of quarter threads are provided for up to 7 per inch, and half threads above that number. For compound gearing the opposite edge of the smaller disk is used, and the gears are indicated by precisely the same method, and by the use of the same graduations on the larger disk, but the operation of matching the graduations is repeated for each pair of gears used in the train. Though intended primarily for use in computing gears, it is obvious that many other problems can be solved by the device. For instance, the size of pulleys for given speeds can be indicated, etc. A similar device is made for use in cutting spirals by which the necessary calculations can be made without the use of a table of tangents. A coat of varnish is applied to the cardboard, to protect it and allow of its being cleaned, and all necessary accuracy is secured in their construction.

Full instructions for use accompany each instrument. They are made by G. S. Hawkins, 35 Vanderbilt st., Brooklyn, N. Y.

Robert B. White, of Shrewsbury, N. J., says he has a way of indicating centers in stock to be turned that he finds very useful at times. He takes a universal chuck and fits a center punch to just move freely through the plain hole in the chuck. Then, by putting the chuck on the end of the shaft and driving in the center punch, the center is indicated. This he often finds useful in the instance of shafts not easily handled. In small shops, where no centering machine is used, Mr. White's plan might frequently be employed to good advantage.

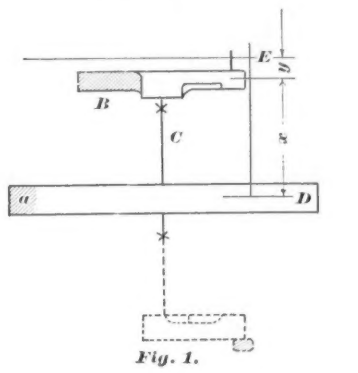


Fig. 1.

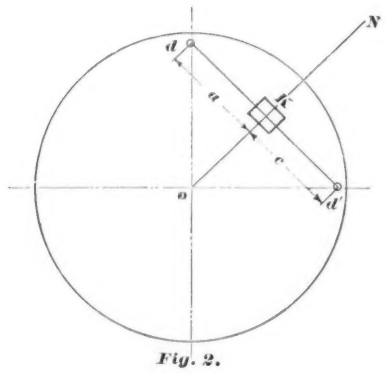


Fig. 2.

Stationary Engine Balancing.

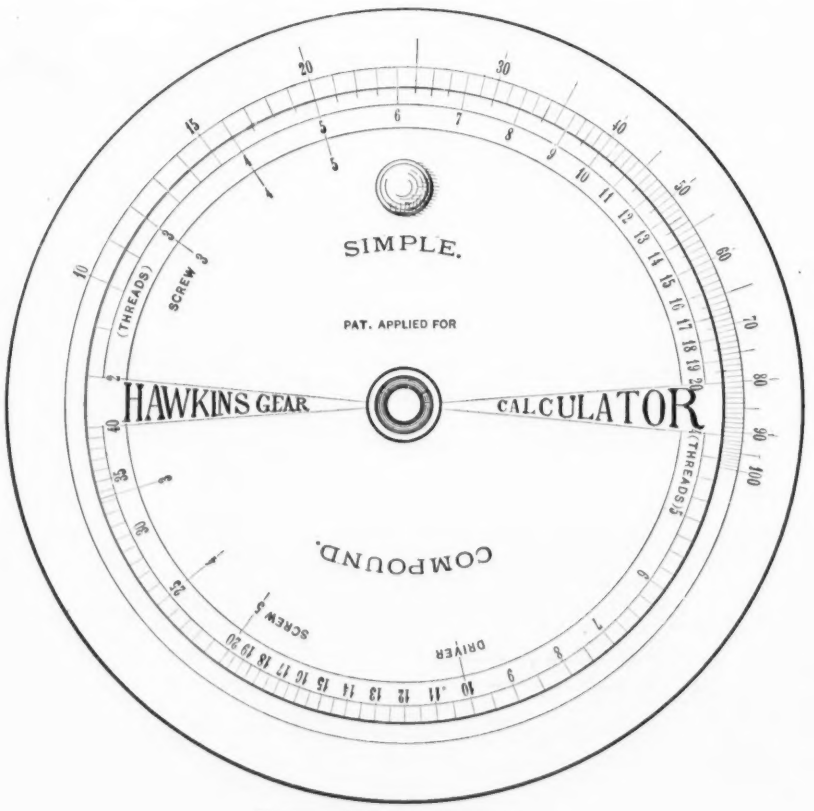
BY W. H. BOOTH.

In balancing locomotives it is not a difficult matter to balance them very accurately in the horizontal plane both longitudinally and transversely, but this is not done, because of the enormous unbalanced vertical action, which is set up by the revolving counterweights necessary to complete balance. This action is detrimental to the track, especially where the rails are light, and it is a cause of serious increase in bridge stresses. The arrangement of balance weights in the locomotive is, therefore, very largely a compromise, and horizontal stability is somewhat sacrificed to avoid too great vertical non-balance.

In stationary engines, however, of the horizontal type, the effect of this latter action is of no account where the engine stands upon a solid foundation of mass sufficient to withstand the repeated impulses of a revolving counterbalance without vibration. Cases, however, have occurred where it has been found impossible to work an engine on a second floor, where there was no foundation weight; for the repeated impulses of the counter-weight would set up such serious vertical vibrations as to endanger the safety of the floor beams as well as prevent the action of other machines. In such an event occurring, a cure might, perhaps, be effected by allowing the engine to run unbalanced in the horizontal plane, and such examples teach a designer that an engine which is apparently perfect may be the reverse of satisfactory if placed in another building; and he may learn also that a horizontal engine is by no means to be described, as the writer has known it described, as a "vertical engine laid on its side." Let us assume here, however, that something is to be said on the balancing of a horizontal engine which is intended to work on a good foundation. It has been said over and over again that the requisite procedure in such case is simply to fix a weight within the fly-wheel or belt pulley exactly opposite to the crank, and of a weight sufficient to balance the crank and such portion of the weight of the rod as rests on the crank-pin. For engines of moderate speed this is by no means a plan to be despised, for it offers facilities for stopping the engine at any part of a revolution, whereas, otherwise, the tendency is to stop shortly past the half stroke. Such a balance, however, by no means indicates that the engine will run steadily, nor is it a steadier of the engine against horizontal twisting. Indeed, such an engine, if loose on its bed, would twist back and forth as though swiveled on a vertical spindle.

Before we can proceed to adjust, or even design a proper balance, we must know what are the elements of disturbance with which we are called upon to deal. First of these we have the crank, then the pin, and the weight of the rod on the pin. These constitute the revolving weights, and can be balanced vertically by a weight of equal moment placed opposite the crank, but we shall see later that they require something further.

The remainder of the disturbing influence is the piston, rod and crosshead. These move only in the horizontal plane, and can be equilibrated in that plane, and in that plane only, by a weight set opposite the crank in the fly-wheel. These reciprocating parts cannot be balanced vertically, and this is not called for in the present case of an engine on a good foundation.



HAWKINS' GEAR CALCULATOR.

So far as regards the turning effort on the crank, the piston and its connections do not exert any force, for they preserve a uniform level. It is clear then that we have placed a total weight opposite the crank, which is as much heavier than the revolving parts as the weight of the piston, rod, etc. Consequently such an engine always tends to stop with the crank vertical, and there is a tendency for the engine to run slow during the half revolution of the crank from the up vertical position to the down, and equally so an opposite tendency, as the crank is rising, owing to the downward weight of the extra balance bob.

Expedients will suggest themselves to the designer to counteract this tendency, as, for example, when the air pump is driven by an eccentric, or by a drag-link connected crank, when the lift stroke of the pump is made to coincide with the period of downward revolution of the balance weight. So far, however, we have only secured a balance horizontally in the longitudinal center line of the engine, and it now remains to adjust the transverse equilibrium. To understand this, refer to diagram Fig. 1, representing in plan a single horizontal engine. To balance such an engine in the faulty way described would require a weight at *a* opposite the crank, and equal in moment to the whole moment of the disturbing forces. Now it is clear that, as the engine revolves, there will be a tendency to twist the whole machine to and fro about some point, as *c*, midway between the disturbing forces.

How can this twisting action be prevented? Very simply. We may add another crank, as shown by the dotted lines, and with a weight at its crank-pin, such as to be just the equal of the working crank; then, by doubling the weight *a* in the fly-wheel, a perfect horizontal balance will be attained, wholly free from twisting tendency. This plan suggests, in fact, a pair of engines with cranks on same side, and we would here take occasion to remark that, when not considered necessary to place the cranks of a pair of engines at right angles, a very effective and useful arrangement is to place the two cranks as in the diagram, with an exactly opposite balance weight, as at *a*. A pair of engines with cranks placed opposite is always in perfect standing balance, but is exposed to enormous twisting moments, and cannot be looked upon as a good mechanical piece of work.

For a single engine, however, such a plan as this second crank would be pedantic and costly, as well as inconvenient and wasteful of room. Can we not then modify the arrangement whilst retaining the principal? A little study shows us that we can. In the plan we may see we have three separate weights revolving in three distinct planes—the two outer weights, the cranks, moving in one direction, and the central weight *a*, moving in the opposite direction. We must therefore adhere to this idea, and we will consider first that one outer weight revolves in the plane of the crank-pin. The crank itself we will balance by a tail, as *B*, exactly opposite, and to this tail *B* we will add a further weight to balance the pin, rod and piston, etc., which move in the plane of the crank-pin center. We have now exactly balanced the crank and have moved the weight *a* to *B*, but we still have *B* revolving in a different plane from the crank-pin. We cannot place *B* exactly in the plane of revolution of the pin center, because, if we did, it would strike the connecting rod every revolution.

We now require a third weight to represent the dotted crank, and this third weight we will place at *D*, and we have the combination of two outer weights balanced by an intermediate weight *B*. Now *B* will have to be as heavy as the sum of *D* and *E* in addition to the weight of the crank, and we must know the weight of *D* first.

Assuming *D* to revolve in a radius equal to the crank radius, we must so proportion *D* that $D \times x$ is equal to $E \times y$, that is, each disturbing weight is inversely as its distance from the plane of revolution of the balance weight *B*. Now we know *E*, and the design of the engine fixes *x* and *y*, therefore $D = \frac{E \times y}{x}$. Expressed in the form of a rule.

(To find the balance weight in a fly-wheel which is required to balance an engine with a fan-tail crank, find the total weight of moving parts from the piston to the crank-pin inclusive. Multiply this by the distance between the crank-pin center and the center of the fan-tail balance, and divide the product by the distance from the center of fly-wheel to the fan-tail. The quotient is the weight of the balance *D* if fixed at the same radius as the crank-pin. If fixed at any

greater radius, as is usual, decrease the weight as found as the radius increases.) Thus, at double the radius of revolution, D would be halved.

Now the weight B must be equal to the sum of the weights E and D plus the weight of the crank, E, B and D being assumed as revolving at the same radius. B being thus figured out may then be actually made heavier or lighter, according as its center of gravity revolves in a less or greater radius than the crank-pin. The balance by fan-tail is the surest and best method of eliminating twisting moments, the only unbalanced forces then existing being the vertical action of the supplementary weight D, and the same of the excess of weight B above the revolving weights concentrated at the crank-pin. This excess weight is equal to the sum of the rectilinear moving parts of the engine and the weight D.

Exactly the same method of calculation is applicable to the case of a pair of engines with cranks at right angles. Such calculations lead to the finding of two weights, d, d', to be placed in the fly-wheel, as in Fig. 2. If desired, however, a single weight k, equal to the sum of the weights d, d', may be used instead. This weight k must then lie on a line joining d, d', and when d and d' are of different weight, as they would be in a compound engine, then k will lie nearer to the bigger one, and divide the line $d - d'$ into segments, such that $d \times a = d' \times c$. Having located k with these proportions, its position may then be anywhere on the radius $O\ N$, so long as its weight is made to vary inversely as its radius of revolution. For simplicity in calculation it is always best to figure everything on the assumption that every weight revolves in the same radius as the crank-pin. By so doing, k is found with ease and accuracy, and can be finally fixed to suit the chosen radius, which may be double, or even quadruple the crank radius.

The points to be borne in mind are: 1st, that for balance in the longitudinal direction of motion, the product of the disturbing weights by the radius of their revolution must be equated with the product of the balance weights by its radius of revolution.

2nd, that a truly horizontal balance, or one in which there is no tendency to twisting, or, as usually termed, wriggling, cannot be obtained where the disturbing weights are balanced by another weight revolving in a different plane, but that a third supplementary weight may be added, as shown, by which perfect balance can be effected.

3d, that, when a fan-tailed crank is used as a balance, and the distance from it to crank-pin center is fairly short, the use of a supplementary weight in the wheel may often be dispensed with as hardly necessary to a practically correct balance.

With these points before us it is easy to see that, with large engines in which the crank balance is not used, there may be considerable practical difficulties in the way of accurate balancing of horizontal forces.

It is apparent, also, that, for engines to be run on an upper floor, the balanced crank affords the best means of equilibration, for, when balanced in the wheel to the standing

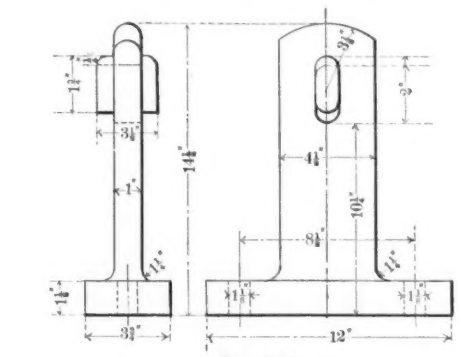


Fig. 563

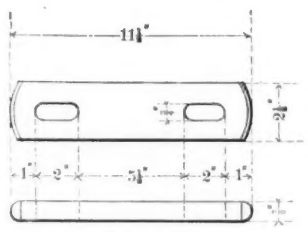


Fig. 564

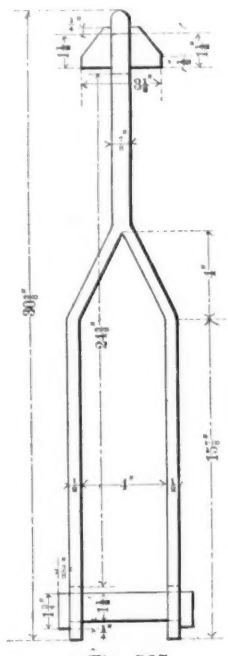


Fig. 565

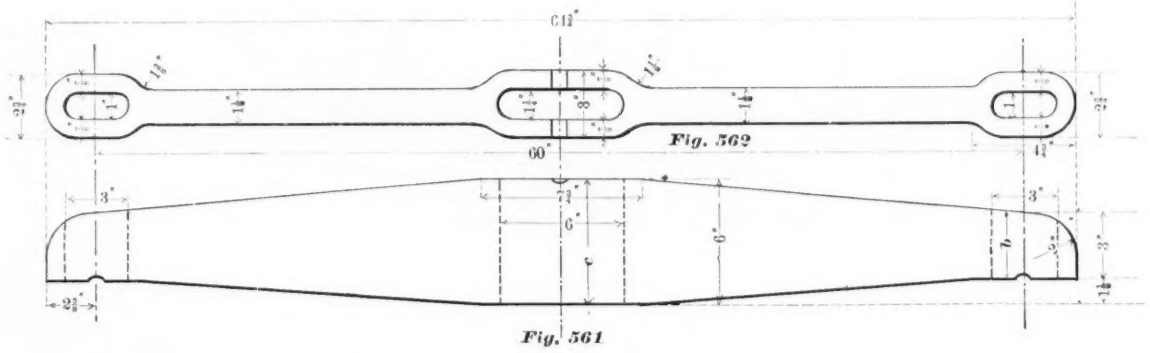


Fig. 562

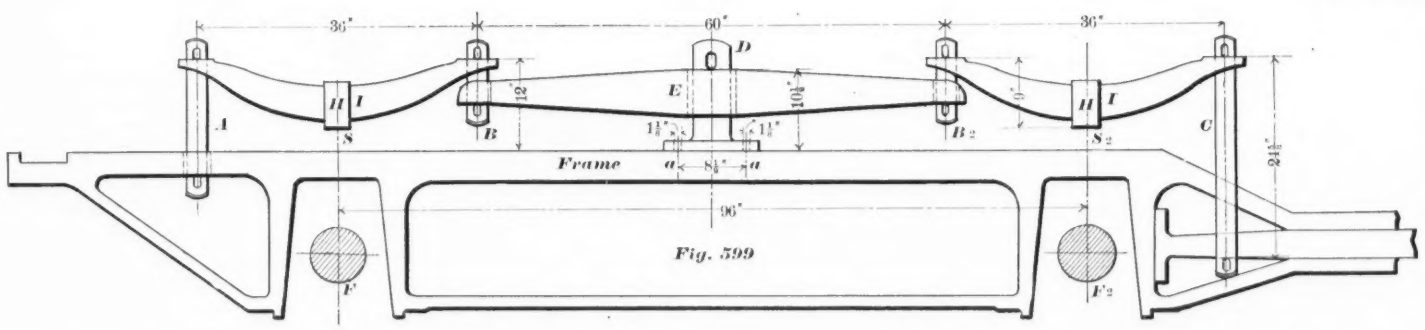


Fig. 599

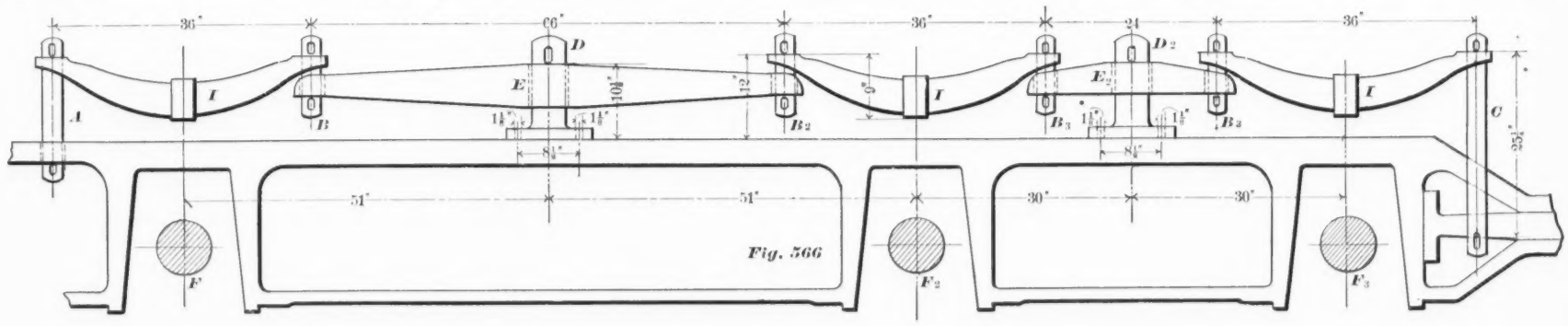


Fig. 566

Modern Locomotive Construction.

BY J. G. A. MEYER.

ONE HUNDRED AND FOURTH PAPER.

Fig. 599 represents the spring gear for the driving wheels under an eight-wheeled passenger locomotive, with cylinders 17 inches diameter and 24 inches stroke. Of course in this class of engines we have only two driving axles, and these are marked $F\ F_2$. The spring saddles, and their position on the driving-boxes, and the manner of placing the springs on the saddles, have been illustrated in Figs. 303, 304 (fifty-third paper). In the illustrations before us we have only shown the center lines $S\ S_2$ of the spring saddles. This design of spring gear is probably the most common one used for eight-wheeled engines 4 feet 8½ inches gauge; a few builders make changes in the minor details, but the design as a whole remains the same. A, B and C are the spring hangers; separate views of the hanger A are shown in Fig. 563; of B, in Fig 564, and of C, in Fig. 565. Figs. 561, 562 show separate views of the equalizing lever E; and Fig. 560 shows separate views of the lever fulcrum D; all of these are made of wrought-iron.

In this design the lever fulcrum is bolted to the frame with two bolts, but we believe it to be better practice to fasten it with four bolts, whenever the design of engine will admit that number of bolts. The central slot in the equalizing lever is cut sufficiently large to allow the lever to vibrate around the gib or key through the lever fulcrum. The equalizing lever is connected to the springs by the link hangers B, B_2 passed through the slots in the springs, and in the ends of the equalizing lever; the outer ends of the springs are connected to the frame by the link hangers A and C; the springs and equalizing lever form a system of levers free to turn about their respective fulcrums.

Fig. 566 represents the driving-wheel spring gear for a ten-wheeled engine. The only difference between this spring gear and the one shown in Fig. 599 is that the former has one more spring and equalizing lever on each side of the engine than the latter.

These springs support the greatest portion of the weight of the engine; a smaller portion is supported by the trucks; the axles, wheels, driving-boxes, spring saddles, and springs are supported directly by the track; the side rods, a part of the main rods, part of the eccentric rods and the eccentrics are also directly supported by the track; and these weights subtracted from the weight on the driving wheels will give the load on the driving wheel springs.

The purpose of the equalizing levers is to distribute the weight equally on the driving axles, also to reduce the effects of shocks caused by the rails, and to allow the wheels to adjust themselves readily to any unevenness in the track without throwing an undue strain on the frames and other parts of the locomotive. It will readily be seen that when one wheel receives, through the unevenness of the road, a shock, it is immediately transferred to the spring; a part of this shock will be transferred through the outer spring hanger to the frame, and the other part will be transferred to the equalizing lever, and from thence thrown on the next spring; or again, if one spring becomes momentarily burdened by an oscillation of the engine, the equalizing lever will immediately transfer a part of this load to the next wheel, thereby distributing the effects of the shock among all the axles. If, on the other hand, an equalizing lever is not used, the whole effects of the shock must be resisted by one spring, and this spring must be made strong enough to enable it to do so; consequently the spring must be made heavier than it need to be with an equalizing lever; but making the spring heavier will also reduce its elasticity, which, in turn, will greatly increase the danger of breaking the axle, saddle, spring hangers and spring;

heavy springs will also make the riding on the engine very uncomfortable, and, in some cases, to such a degree as to be almost unbearable. From the foregoing remarks we can readily conceive the advantages gained by the use of equalizing levers.

In eight-wheeled passenger engines, and also in ten-wheeled engines, all the driving wheel springs are connected by equalizing levers. But we will presently see that for mogul and consolidation engines it is not practicable to connect all the driving wheel springs in this way.

In determining the thickness and depth of the equalizing lever we generally find that design of the engine will establish the thickness. For instance, in many engines the pads which connect the boiler to the frame are placed at each side of the lever fulcrum *D*, and the nuts which fasten the pads to the boiler will be along one side of the equalizing lever. There should be at least $\frac{1}{4}$ of an inch clearance between these; and since the levers are generally made of a symmetrical form, it follows that the design and position of the pads will generally establish the thickness of the equalizing lever; this thickness rarely exceeds $1\frac{1}{2}$ inch; and for small engines, say with cylinders 9 inches in diameter, will sometimes be $\frac{3}{8}$ of an inch.

Before we can determine the depth of the equalizing lever we must know the load to which it is subjected. Take, for instance, the spring over the journal *F* in Fig. 599. The load on this spring will be equal to the pressure on the journal *F*; one-half of this load will be transferred to the spring hanger *A*, the other half to the spring hanger *B*. In order to produce equilibrium, the force acting at the other end B_2 of the lever must be equal to that at *B*. The force at B_2 is equal to one-half of the reaction of the spring over the journal F_2, and this reaction is equal to the pressure on the journal F_2. This mode of reasoning shows that the pressure on the journals will be equalized; in other words, the pressure on the journal *F* will be equal to that on the journal F_2. It further shows that the tension on each spring hanger is equal to one-half of the pressure on one journal, or one-quarter of the sum of the pressures on the two journals *F* and F_2; and the tension on the fulcrum *D* will be equal to one-half the sum of the pressures on the two journals. Consequently the equalizing lever *E* must be considered as a beam loaded at the center, and freely supported at the ends, the length of the lever being equal to the distance between the centers of the spring hangers *B* and B_2, and the load equal to one-half the sum of the pressures on the journals *F* and F_2. Thus, for instance, if the pressure on each journal is 1,000 pounds, then the sum of the pressures will be 2,000 pounds; the tension on each spring hanger will be 500 pounds; the tension on the fulcrum *D* will be 1,000 pounds, and consequently the load on the equalizing lever will also be 1,000 pounds. In our next paper we will work out a practical example.

Improved Index Centers.

With this we give an illustration of new index centers, made by the Kempsmith Machine Tool Co., Milwaukee, Wis. As shown, it rests upon a section of the platen of a milling machine built by the company, to which it is specially adapted, though, of course, it can be used wherever index centers are used. The spindle in the universal head can be depressed 20° below a horizontal line, and 5° beyond the vertical. The spacing worm is made in halves, to allow of adjustment for wear, and this adjustment can be made from without. A hole through the spindle allows pieces $1\frac{1}{16}$" diameter to pass through, the hole being tapered to receive the same arbors as are used in the milling machines. The end of the spindle is threaded to receive a chuck. Three index plates are furnished, by means of which any division usually required can be made.

The foot-stock has a new and valuable feature, which consists in so forming the block that the center comes at the inside upper corner, where it is accessible either from the top or the side for any kind of cutters, enabling side milling to be done with cutters of large diameter, out to the end of the work, the cutter passing by the foot-stock. This feature enables the use of the smallest cutters to be largely avoided, and the efficiency of the machine is considerably increased, as will be perceived by those familiar with the subject. The head swings 10", and the head and foot-stock together weigh 85 pounds.

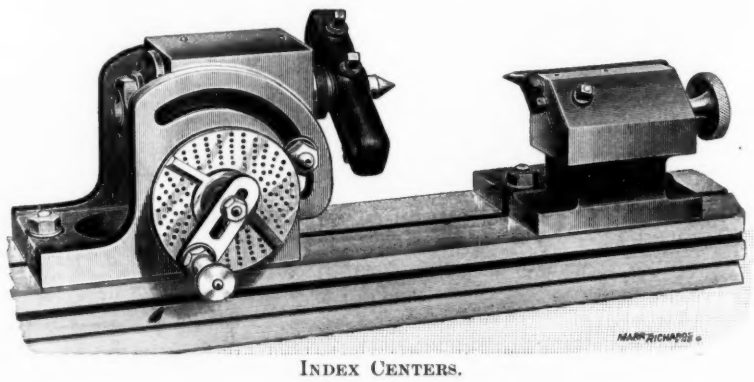
LETTERS FROM PRACTICAL MEN.

Lathe Centers.

Editor American Machinist:

After reading Jarno's first article on lathe centers, the same thought occurred to me that was suggested by Prof. Sweet, namely: Why did not the tool maker re-bore all the spindles instead of making collets? Or, if it be desirable to have the lathe centers repaired in the tool-room, in which case collets might be necessary, it would still be better to re-bore the spindles, as there would, in that case, not be needed more than from two to four sizes, which would cover a wide range of lathe capacity. An objection to repairing centers in the tool-room is, that it is frequently found that lathe spindles have their center sockets slightly eccentric with their journals. This may be due to original construction, or to the journals wearing more on one side than the other. It is obvious that in such cases the center should be ground in its spindle, and its position marked.

That Jarno may succeed with his lathe center reform, is a "consummation devoutly to be wished." Possibly he may have something to say in favor of larger centers before he retires from the field. I am inclined to think that the present sizes are rather too small when the center is new and long. I have in mind a lathe which is sufficiently heavy in most respects, but the centers are entirely too small. The live spindle center has been known to take a permanent bend while a 12" hydraulic ram was being turned.



INDEX CENTERS.

In using the lathe for boring, lathemen generally do, and always should, use some means to prevent the borings getting into the center socket. A hardened steel "dummy" center, faced off even with end of spindle, would answer well; it would not only protect the socket from borings, but would at the same time prevent thoughtless workmen from mutilating the same. A hole could be tapped in the end of this "dummy," to provide for withdrawing it from the socket.

There is much that might be said as to the "use and abuse" of lathe centers; doubtless we shall hear from others on this.

LENOX.

Decimal Measurements.

Editor American Machinist:

Your correspondent, C. U. Reed, October 24th, treats us to a repetition of the objections urged by opponents of the decimal system against its general adoption in workshops, which he frankly says are statements, and not facts. He evidently has had little experience with the practical working of the decimal system, and is ignorant of the progress we are making in this direction.

In former years, influenced by the opinions of older and more experienced persons, and before he had any experience with the practical working of the decimal system, the writer was amongst its opponents; in after years he was compelled to practice it in both the drawing-room and workshop; its superiority became so manifest that he prefers to practice it wherever the conditions will admit of it. Instead of the proper remedy taken in small doses for the decimal fever, which your correspondent suggests, I would advise a more rational and practical plan for any person wishing to test the merits of the two systems, and that is to engage in the employ of a concern practically working them. After becoming familiar, if he does not concede the superiority of the decimal for convenience and accuracy, he will differ from ninety per cent. of those that I have met with having similar experience.

There are establishments where the two systems are worked with equal facility, and I believe I am correct in saying that the managers of those establishments give the superiority of the decimal their unqualified approval. It is true the vulgar fraction is exact. Here is one—$\frac{3}{7}\frac{7}{6}\frac{5}{8}$—taken from a working drawing made by a competent person, and made necessary to complete a chain of dimensions. Of course to measure it conveniently, it should be reduced to its decimal equivalent.

You effectually dispose of the "chestnuts" thirds and sixths, when you say the "common division will not give one-fifth, and the argument seems as strong one way as the other."

The difficulty attending the general introduction of the decimal system which some apprehend, is more imaginary than real. Workmen generally are wary when dealing with figures; while $\frac{5}{32}$ would excite no unusual interest in many, its decimal equivalent .15625 would appear as a specter before them; but this figure fright disappears with familiarity.

Your correspondent exposes the weakness of his case when he says an hundredth of an inch is too small for use. If he will attempt to reduce a few square inches of surface to that extent by filing on a sultry day, I think he will appreciate what a sensible quantity it is.

Were I to design a structure to be built in a shipyard, boiler shop, and I may add a great many machine shops, I would certainly not employ decimal dimensions, for the reason that they have no use for the refinement for which the decimal system is especially adapted. On the other hand, were I to design a special machine requiring great refinement in action and dimensions, and allowed the discretion, I would unhesitatingly use decimal dimensions—except for holes and screws—and select an establishment for its construction familiar with the practical working of the system, because I would feel assured that their facilities, and the training of the workmen, were adequate for the work. If there is any force in the arguments against the general adoption of the decimal system, it is the inconvenience a change of system would occasion. But this is exaggerated. It would, in most cases, be no more inconvenient than a change of character of work causes. I know a shop conducted hy an excellent mechanic, doing a fair business in a certain kind of work, where the principal gauges are notched sticks. Now any other kind of work done there would cause some inconvenience, at least to the extent of other notches in the sticks, or other sticks notched.

The opposition to the decimal system generally proceeds from two sources, one is from that conservatism which grows with experience and years, and the other from inexperience, influenced by that conservatism.

All reforms have met with opposition, chiefly because their success necessitates the obscurity or destruction of things to which many have become wedded. Destruction of the less fitted is the underlying principle of evolution. The course of progress is strewn with the wrecks of obsolete processes and systems.

Let the decimalists continue the battle so courageously begun, and sustained by them, be encouraged by the results already accomplished, for surely their system is growing in favor, and in use as well.

DECIMAL.

An Engine-Room Conversation.

Editor American Machinist:

The following little story I put at your disposition:

"Say, John, the superheater is leaking."

"So? how did that happen?"

"I don't know just exactly, but as soon as the pipe became red-hot, the steam blowed out of the patch."

"H'm, didn't you put on that patch?"

"Yes; and tried the best I could."

"Well, tell me how you done it, and I may be able to help you."

"There ain't much to tell about it. The pipe was cracked about $1\frac{1}{2}$" long, and badly burned. I fitted a piece of $\frac{1}{4}$" sheet-iron about 6" long snug half around the pipe, filled in with red lead, and tightened the patch with three clamps. When the job was done I turned on the steam, left it under 70–80 pounds pressure for about one hour, and there wasn't the slightest leak. But when I started the fire under it the steam temperature rose to about 900°, the patch commenced to leak so badly that I had to pull the fire."

"And what are you going to do now?"

"I think I'll try litharge instead of red lead."

"Nonsense, my boy, just sit down and think matters over for a minute."

"What do you mean?"

"I think that red lead or litharge don't agree together with a red-hot pipe. See, here I got an old, cracked elbow, we split it into halves, and now we got two crucibles. In one we put a little red lead, in the other a little litharge, and shove them in the boiler furnace. Now the iron is red-hot; we take them out, and we find no red lead or litharge, but a little dust or powder, and molten common lead. Do you understand, now, why your patch didn't hold tight? You use steam at a temperature of 1,200°, and lead melts at about 612°. Red lead ($Pb._3 O._4$) and litharge (Pb. O.) are protoxides of lead, and their fusion point is about the same as that of the latter, hence your failure."

A piece of sheet asbestos made a durable and tight joint. HERMANN HEYRODT.

"Catching Threads."

Editor American Machinist:

In the issue of Oct. 10, "C. H." inquires about throwing the nut out in cutting threads to return the carriage by hand. The rule you gave will not apply in all cases. I send you a rule I have tried for some threads lately, and it works well, and think it will work in cutting all threads.

Multiply the distance between threads to be cut by a whole number, which will about equal the whole number of threads to be cut on the shaft. This number must either be a multiple of the threads per inch of lead screw, or a multiple of the denominator of the fraction which expresses the distance between threads to be cut; the product will be the distance in inches to run back the carriage, which must be done while lathe is idle.

Care must be taken to have the denominator of the fraction, if there be one in the product, the same as the number of threads per inch of lead screw, or increase the fraction so it will be; for, if the fraction was in thirds, it would not do if the lead screw was 4 per inch. Below are some examples I have tried in the lathe:

Threads per Inch to be Cut.	Pitch of Thread.		Whole Number of Threads to be Cut.		Distance to run Carriage.
$1\frac{2}{3}$	$\frac{6}{7}$	×	$\frac{14}{1}$	=	10
$1\frac{9}{23}$	$\frac{23}{23}$	×	$\frac{16}{1}$	=	$11\frac{1}{2}$
5	$\frac{1}{5}$	×	$\frac{5}{1}$	=	5

In the first example the nut can only be unlocked at five inches, or a multiple of it. If this is of no account, throw it away.

Joliet, Ill. E. J. BAKER.

[We did not intend, in our answer, to give directions for fractional threads, but only for whole numbers. We may remark, in relation to the above, that the number chosen for the multiplier should always be larger than the whole number of threads to be cut, because some leeway must be allowed for starting in the cuts and taking up all lost motion. In the instances given by Mr. Baker the distance run back is fully equaled by the space occupied by the threads to be cut. Things must be so arranged that the carriage, when run back, must pass over a whole number of threads on both the screw being cut and the lead screw, and, at the same time, allow sufficient extra space beyond the end of the screw for adjusting the tool.]

Recovering Babbitt Metal.

Editor American Machinist:

An easy method for recovering babbitt metal from dross is to wash the dross with plenty of water in a fine meshed sieve; if in lumps, crush fine in a mortar before washing.

R. T. TORKELSON.

Hatfield, Mass.

Pumps Working under Pressure.

Editor American Machinist:

Regarding the query No. 397, I have just been through the experience which fits the case, and therefore take the liberty of writing you.

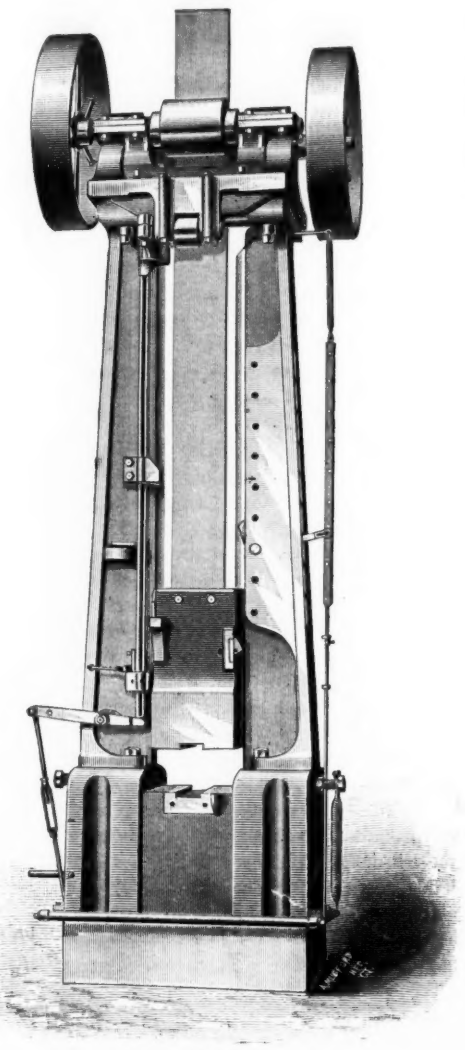
The ordinary piston pumps used for water-works should not be used with pressure on the suction. Water moving under pressure will absorb or carry off the air contained in the air-chamber in a few days. The duty of keeping air-chamber full devolves on the attendant; in our case this item was overlooked three times, and each time some part of the pump gave way. This was not due to any fault of the pump, as it was made by prominent and reliable makers for 120 lbs. duty, while we used it to make up a difference of 36 lbs. only. We are now doing this work with a centrifugal fan pump made specially for the purpose, with perfectly satisfactory results. In our case one very important advantage is that the outlet can be entirely shut, without adding any strain on the pumping outfit, the gauge at the pump going up less than two pounds when outlet is closed. The duty is constant, except from 7 A. M. Sunday morning to Sunday night 12.

A centrifugal pump of sufficient capacity to run at a speed that will give 20 lbs. per square inch, and made with proper size bearings, shaft, pulley and pipe connections, will work successfully in every way. The centrifugal pumps ordinarily made are unfit for satisfactory service—*too cheap*. A thoroughly reliable pump is required; such a pump, in my experience, will do satisfactory work.

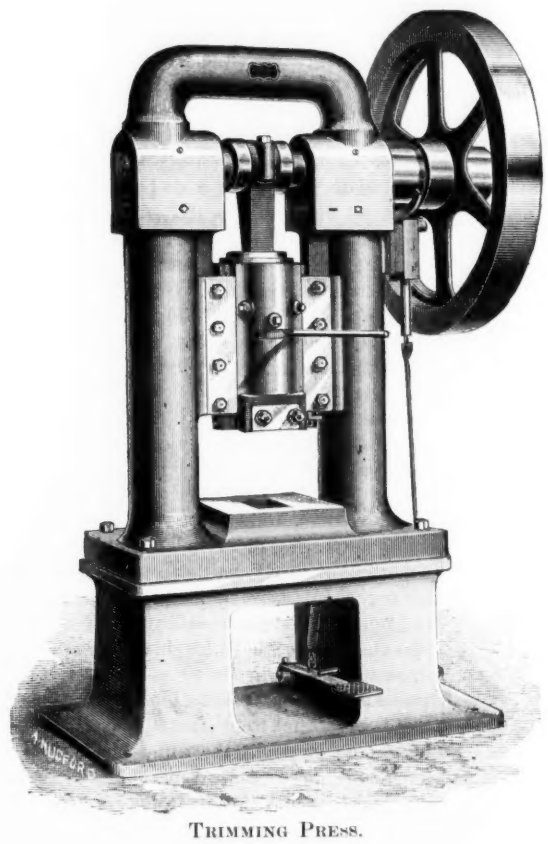
Watertown, N. Y. A. H. LEFEBVRE.

Some Improved Machine Tools.

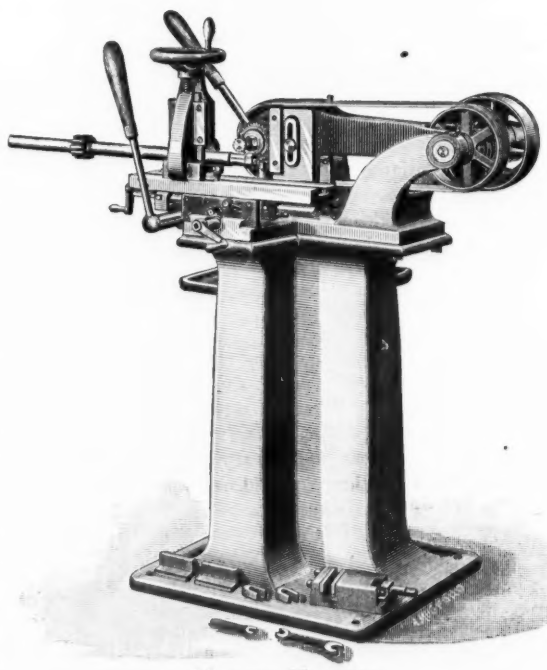
We give with this some illustrations showing some recently improved and some newly designed machinery, brought out by The Pratt & Whitney Co., Hartford, Conn. The drop-hammer is raised by means of a flat-surfaced strip of tough wood, which engages with the faces of finished cast-iron rolls, driven by pipe-arm pulleys at the ends. One of these rolls runs in fixed bearings, and the other has its bearings in a yoke suspended on journals, which allow it to be moved towards its fellow, to engage with the surface of the lifting-board. This yoke has a central portion projecting downward and engaging, by a connecting-bar, with a cam, operated by a vertical starting-bar through the medium of a crank lever. By this combination, a much greater force is exerted, instantaneously, in placing and retaining the roll in contact with the lifting-board, than is possible when the starting-bar is connected directly with the roll-bearings. The two rolls and the cam mechanism are parts of the head-piece, which may be removed as a whole, or the rolls may be removed separately. An automatic and adjustable stop holds the drop suspended at any height desired. An automatic trip may be attached, which will secure a series of blows of uniform force, at the will of the operator, who can, however, instantly change it from the full impact of the drop falling from the extreme height of the lift to the simple pressure of the weight of the mass without motion. This absolute control and instant adjustment of the force of the blow will be appreciated by all practical forgers. The workman has the free use of his hands in operating the machine, as its action is governed entirely by his foot. With each machine is furnished wrenches, and also a steel die-bed secured by a key. This die-bed saves the trouble and expense of dressing the main bed by a chisel and file, or by planer, in case of damage, and also adds to the strength of the machine by increasing its resistance to the shock of the blow. The weight of beds will be increased as ordered. In the smallest machine built, the hammer weighs 250 pounds, and has an extreme fall of 5 feet, the total weight of the machine being 5,000 lbs. The hammer in the largest machine weighs 15,000 lbs., has a fall of 6 ft. 4 in., and the total weight is 24,600 lbs. Seven sizes are built. The trimming press may be used in connection with the drop-hammer for trimming forgings or for punching. The crank is of steel, and is made with a throw of 6″ or less, as may be ordered for trimming or for punching. The bearings are $3\frac{3}{4}$″ diameter and 11″ long. The driving-wheel is 40″ diameter, weighs 775 pounds, and receives a 5-inch belt. A foot-lever actuates a stop-motion, that stops the plunger, always at the highest point of stroke. The plunger travels in gibbed slides, and is bored to receive a solid piston, which is attached to the crank by a connecting bar. This piston is threaded to match a threaded ring or nut placed in the central part of the plunger. The adjustment is accomplished by means of this nut. When in the proper position it is rigidly held by means of a set-screw. The bed can receive a die-plate 16″ × 17″, hole in bed-plate 4″ × 6″, which may be varied in building. Speed of driving-wheel, 80 revolutions per minute. Weight of machine, 5,000 pounds.



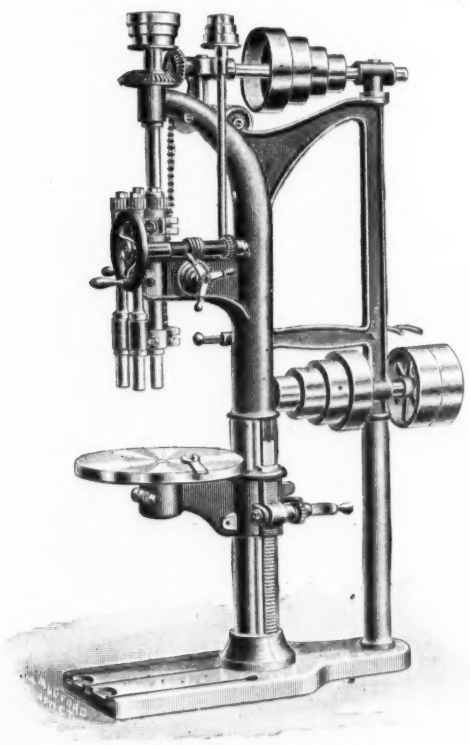
DROP HAMMER.



TRIMMING PRESS.



MILLING MACHINE.



SPECIAL DRILL PRESS.

The drill press shown is intended for special manufacturing operations where two or three holes of the same or different sizes are to be drilled, and the nature of the work admits of their being drilled simultaneously. The machine is built in the main like the regular No. 3 Manufacturers' Drill, built by the same company, with automatic feed, with or without back gears. The additional spindles, $1\frac{1}{8}$ inches diameter, are driven from the main spindle by spur gearing. They run at the same speed and in same direction as the main spindle, are adjustable from $2\frac{7}{8}$″ to $8\frac{3}{8}$″ apart, center to center, and may be rigidly secured at any point within these limits. The key-seat milling machine was designed, we believe, with special reference to the work connected with the "Woodruff system of keying," which is in use in the shops of the builders, but it is applicable to many other kinds of work. Being designed for use with both lever and screw feed, the change from one to the other can be readily made without adding to or taking from any part of it—a very desirable feature, not embodied in other machines. The slide moves by the rack and pinion $3\frac{1}{2}$″ or by the screw 12″. The cross-movement of the slide, is 4″, and the vertical movement of the spindle $3\frac{1}{2}$″. The spindle counterbalanced, to better adapt it to delicate work, is made of hard steel, and has anti-friction bearings. The greatest distance of the spindle from the top of the slide is 5″, and from the top of rise $3\frac{1}{4}$″. The pulley on the spindle is 7″ diameter, 2″ face. The machine weighs complete 658 lbs.

James Prescott Joule.

James Prscott Joule, who died recently in England, in the seventy-first year of his age, came as near immortalizing his name amongst English-speaking people as it is possible to do, for it was he who determined the mechanical equivalent of heat, which is likely for ages to be spoken of as "Joule's equivalent." If Dr. Joule had accomplished nothing but this, it would have been fitting work of a lifetime, for the world is vastly his debtor for this labor. His works, however, were numerous, although he is and will be best known through his researches in the direction of work and heat. With the advantage of ample means he was able to devote his lifetime to researches of a scientific nature, and to give the world the benefit of his researches.

AMERICAN MACHINIST

To prevent delays all Communications should be addressed to the Company.

PUBLISHED WEEKLY

BY

American Machinist Publishing Co.

96 Fulton Street, New York.

HORACE B. MILLER, Pres't and Bus. Manager.
LYCURGUS B. MOORE, Treas. and Sec'y.

F. F. HEMENWAY, Editor and Mech. Engineer.
J. G. A. MEYER, } Associates.
FRED J. MILLER, }

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The International News Company,
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NEW YORK, NOVEMBER 14, 1889.

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Some Facts in the Case.

A reader who lives in Paterson, which is the center of our American silk-weaving industry, sends us an editorial article clipped from the *American Economist*, entitled, "The Despotism of Labor," and asks us how the statements made in it compare with Corbin's doings? The article relates chiefly to some action taken by the organization of silk weavers of Paterson to prevent silk weavers from being imported from the old countries to work here, which is something that the proprietors—and almost as a necessary consequence the *American Economist*—do not approve of.

But, after all, it seems to us that this action of the Paterson silk weavers is nothing more than a rather crude attempt to do what is quite common now among those who would consider themselves at least to be far above the Paterson silk weavers in intelligence, *i.e.*, to suppress, and so far as possible prevent, free competition in the supplying of what they may have to sell. This is the chief object of all the numerous trust organizations, and of many organizations which are not classed as trusts. We do not believe it is right to do this, and we do believe that the continued doing of it will result in trouble for all concerned, but it must be admitted that it is at present quite fashionable, and can the silk weavers be so savagely censured for doing or attempting to do for themselves what they see others doing all about them, including probably the proprietors of the silk mills themselves?

There is no import duty on silk weavers, and we do not see how they can be prevented from coming here to work if the inducements held out to them are sufficient to make them want to come. There is, it is true, a law against importing them under contract to go to work; but surely neither our correspondent nor the *American Economist* mean to condemn the American silk weavers for undertaking to see that this law of the land, which was passed in the supposed interest of these weavers, and others like them, is enforced. It seems to us that this is a case of making a fuss about the difference between tweedle-dee and tweedle-dum.

It by no means follows that, because we find things to condemn in the course pursued by Mr. Corbin in respect to labor organizations, that we approve of all that has been or may be done by such organizations. We are free to say that, in the article by Corbin, to which we recently referred, he makes some points which are just and worthy of attention; but as the same objections have been pointed out hundreds of times, and are daily, and, we may almost say hourly pointed out by the newspapers, we thought it unnecessary to refer to them. We ourselves have not hesitated to point them out when occasion seemed to demand it. But we have no patience with Corbin's presentation of the failings of labor organizations, because we are convinced that the subject is one which he cannot discuss with an approach to fairness. What is said about the leveling tendency of labor organizations, for instance, is right enough so far as it applies, and there is no doubt but that it applies to many organizations, though this leveling effect is magnified and dwelt upon by those who, like Corbin, believe and act up to the belief that no organization which could possibly do the workmen the least good should be allowed to exist.

The labor organization which, above all others we know of, enforces, wherever possible, by an iron-clad rule, a leveling policy, is the very organization which has been held up as an example to be followed by all other labor organizations; the ones so holding it up being the very ones who have been most severe in their denunciation of "leveling effects." The locomotive engineers, by their rule requiring that engineers shall be promoted in the service of the road solely on the basis of the length of time in the employ of the road, by what is called the "seniority rule," utterly discount real ability and effort to excel in their business by making the poorest man, who can manage to retain his position, equal in point of chances for preferment with the best man on the road. Nothing can more clearly show the utter unfairness of the current treatment of these questions than the praises which have been literally heaped upon this organization, by those whose chief objection to such organizations seems to be their "leveling tendency." Of course they have done this, in most cases, without knowing anything to speak of, about the locomotive engineer's organization or any other one, but that does not excuse them. We by no means approve of all that has been done by labor organizations, and suppose that, being composed of human beings, they will continue to make mistakes so long as they shall exist. We hope the time will come when there will be no shadow of an excuse or reason for the existence of any of them, but we believe in the right of an American citizen to join one, if he thinks his interests will be advanced thereby. We think that Corbin is a very poor one to tell us about the evils of labor organizations, while he himself belongs to, and controls some organizations, which we believe are more dangerous than any others to be found in this country.

Anything to Beat the Link.

Periodically during the past twenty years some one has come to the front with arguments intended to demonstrate that the Stevenson link as used on locomotives is a wasteful device, and a relic of ignorance. The latest effort of this kind that we have noticed is that of an editorial writer in the *Railroad Gazette*, who, with more zeal than discretion, attacks "a contemporary," whoever that may be, for making the statement that, "For economy of steam the pressure in the clearance space, when the steam valve opens, should be equal to the initial pressure." This statement the *Gazette* writer does not hesitate to pronounce incorrect, for three reasons, which he sets forth.

The first reason is that compressing up to boiler pressure—*initial* pressure is what he quotes "a contemporary" as saying—is not *per se* in the line of good economy. Regarding this, there is probably not an engineer in the country, who has given the matter any attention, that does not know that from purely theoretical reasoning, with the most important question of reheating the cylinder left out of consideration, there is in the locomotive a point somewhat below initial pressure to which it is economical to carry compression. But it is equally well known that not a single device ever employed on the locomotive to reduce compression, as compared with the link, failed to call for more coal to do the same work. In view of this fact, and further in view of the fact that the theoretical consideration of the subject that shows loss from compressing to initial pressure is one-sided—everything being left out that would tend towards a reversal of the conclusion arrived at—a writer is justified in saying of the locomotive at high speed that compression should be carried up to the point of initial pressure. This, however, is not capable of absolute demonstration if we take compression simply by itself. Neither is the reverse of it capable of demonstration.

Secondly, the *Gazette* writer asserts that, owing to high compression, larger cylinders must be used. He says:

In cylinders with large clearance, particularly in locomotive cylinders, where the compression is carried up to the boiler pressure, the area of the card is considerably reduced, and the reduction calls for the use of larger cylinders than would otherwise be necessary to do a given amount of work.

This is a most remarkable statement to appear in the editorial columns of one of the oldest railroad papers in the country, and must have been hastily written. Every one who knows anything about moving trains knows that large cylinders are required at starting, when compression is very small, and of no consequence in reducing the power, and that at high speeds and early cut-off, where compression reaches initial pressure, it would be an advantage if the cylinders were smaller. Here, then, high compression is advantageous, because it does in effect reduce the size of cylinders by reducing the quantity of steam used at a given pressure and ratio of expansion, thereby permitting a full throttle without ruinously early cut-off.

The third point raised is that the power used to compress the steam is principally furnished by the stored energy in the moving parts of the machine, and hence there is much loss from friction. A discussion of this proposition would involve a reference to a diagram of force, which would be out of place here. It may be remarked, however, that the most remarkable examples of smooth and *cool* running high-speed engines are those in which high compression is employed; and cool running is the best evidence in the world of the absence of undue friction.

In concluding this altogether remarkable article, the *Gazette* writer puts aside the opinions of some of the best known investigators of this subject in the country, dismissing them with the short remark, quite to the point, "this is not so."

There are some very good arguments that can be brought against the link, but if no stronger ones than those referred to above are used, a good many old fogies will insist on its having many good points when used on a locomotive.

To put it plainly, the *Gazette* writer appears to have no conception of that which he is writing about. He would do well to give attention to the plain problems underlying the subject before he essays to correct those who have given it years of study, and to set at naught all practical experience in the matter.

The failure of the cotton oil trust shows that there are some commercial laws which must be observed, even by a trust, if it would preserve itself. Those who claim that the economy in production brought about by these trust organizations is a sufficient justification for their existence, will not find a very bright example of this in the operations of the cotton oil trust; for it was shown very clearly that outsiders could and did produce at a profit at the prices fixed by *the trust*, and that, instead of these prices being reduced to force the outsiders out of business, the product of at least one large outside establishment was purchased by the trust at a loss to it. It remains as clear as ever, that whatever economy of production may be effected by trusts, will not inure to the benefit of the public, and that free competition is the only thing which will protect their interests.

QUESTIONS AND ANSWERS.

Under this head we propose to answer questions sent us, pertaining to our specialty, correctly and according to common-sense methods.

Every question, to insure any attention, must invariably be accompanied by the writer's name and address. If so requested, neither name, correct initials nor location will be published.

(420) J. G. T., Hamilton, Ohio, asks: Would you recommend a student of your articles on Practical Drawing to use a section liner? I should think by not using it I would get better practice in doing neat work under difficulties. *A.*—You are right; we prefer to have the students draw the section lines with the T and set square, and not rest satisfied until they can produce as good work as can be done with a section liner. Of course, more time will be needed, but the time will be well spent.

(421) E. F., Palestine, Tex., writes: I am overhauling a set of links requiring new saddles. How much offset shall I give the saddle-pin? Radius of link, 4 feet 11¾ inches; throw of eccentric, 5 inches. *A.*—You have not given sufficient data to enable us to work the offset. See AMERICAN MACHINIST May 10, 17, 24 and 31, 1884. 2. Please give rule for finding the distance between the eccentric rod-pins in the link. *A.*—The distance from center to center of the eccentric rod-pins is generally made equal to 2¼ or 2½ times the throw of the eccentric.

(422) E. S., Newburgh, N. Y., writes: I am a young man 19 years old, have worked three years at the machinists' trade, and would like to become an engineer on one of the ocean steamers running between New York and Liverpool. Will you kindly inform me how I can become one? *A.*—Nearly all the engineers on these steamers are men

who have helped to build the class of engines used on these steamers, and, since these engines are mostly all built in Scotland, we believe it to be a good plan for you to work in one of these shops until you can obtain a position on one of the steamers.

(423) E. L. M., Chambersburgh, Pa., writes: I want to get some books treating on the steam engine and indicator. Could you advise as to which to get? I am a young man in an engine shop here, and have determined to make a special study of the steam engine, but do not thoroughly understand the indicator. *A.*—Text Book on Steam and the Steam Engine, by Prof. A. Jamieson; Catechism on the Steam Engine, by J. Bourne; both of these treat on the steam engine. For the indicator there is Hemenway's Indicator Practice and Steam Engine Economy, Porter's Treatise on the Indicator, Pray's Twenty Years with the Indicator, and other works.

(424) E. H. M., Philadelphia, Pa., writes: I have a boiler six inches in diameter; I would like to get more steam space. If I put a dome over it and connect them by two half-inch pipes screwed into the heads, will there be any danger of tearing the threads when the boiler is subjected to 100 pounds of steam pressure? *A.*—If the heads are sufficiently thick, allowing the thread to extend three-quarters of an inch or more into the heads, and the pipes are screwed into the heads in a workmanlike manner, there will not be any danger of the threads stripping. But we do not like this way of increasing the steam space. The best, and probably the cheapest way in the end, will be to lengthen the boiler shell.

(425) J. H. D., Fairhaven, Mass., asks: What will be the required power to get a speed of 10 or 12 miles per hour out of a boat 30 feet long, 6½ feet wide, with a draught of 26 inches at the stern? The boat is very lightly blanked and ceiled with ⅛-inch cedar. *A.*—In our opinion your boat will be too light to put in engines to give the required speed; 7 to 8 miles per hour will probably be the highest speed suitable for your boat, and, if the lines are not moderately fine, you will not even get this speed. The power required will be about 6 horse-power, cylinders 4½ inches diameter by 5 inches stroke; number of revolutions, 350. 2. What should be the diameter of the propeller, pitch and number of blades, and diameter of propeller shaft? *A.*—Diameter of propeller, 22 inches; pitch, 40 inches; number of blades, 2, and diameter of shaft, 1½ inches.

(426) E. D. G., Philadelphia, Pa., asks: How is the term "modulus of section" used in connection with the following example? We find the area of a rectangle $= b\ h$; modulus of section $= \frac{1}{6} b\ h^2$. *A.*—If you had given us the name of the book in which you found the expression, or the subject to which it relates, it would have been more satisfactory. We recognize that expression as one connected with the strength of material, thus: Multiplying $\frac{1}{6} b\ h^2$ by the stress to which the fiber furthest away from the neutral axis is subjected, we obtain the moment of resistance to bending of a beam whose cross-section is a rectangle; or, putting f for the stress on fiber furthest away from the neutral axis, and M for the moment of resistance to bending, we have

$$M = \tfrac{1}{6} b\ h^2\ f.$$

(427) P. J. O., ———, writes: In your answers to Question No. 358, you give the correct method of finding the diameter of a worm wheel blank at the pitch line. Will you kindly state where the pitch line should be located on a V or square thread worm wheel, and by what rule you locate it? *A.*—Worm wheels for worms having V threads are usually made flat across the face, and in this case the pitch line is at half the depth of the teeth. Square threaded worms are not used, and we presume you mean the form usually adopted where the sides of the threads have an angle of 75½° with the pitch line, as in a rack. The face of the wheel is usually turned to conform to the circle of the worm in such cases, and there is no hard and fast rule as to the location of the pitch line, though the most common, and, perhaps, the best practice on the whole, is to make it at half the depth of the tooth at the center of the face. Some prefer to place it at half the depth of the tooth at the sides, while others take a point midway between these. It depends more upon individual choice and preference than upon any universally recognized rules.

(428) J. F. C., Bentonville, Ohio, writes: I am running a 10″x20″ engine; steam ports, 1¼x6¼; exhaust port, 3x6 inches; bridges, ¾ of an inch thick. The present valve is 8⅛ inches long, cavity in valve, 3 inches. The engine runs too hard, and pounds. Number of revolutions, 120; the engine will run up to this speed with 35 to 40 pounds steam pressure, and it takes 35 bushels of coal per day. I thought of making the valve 7⅛ inches long, and cavity in valve 4⅞ inches, and change the travel from 4 inches to 2¼ inches. I want the engine to cut off at ¾ stroke. Will these changes give the correct result? *A.*—The valve is incorrectly designed, and it is a wonder how you could have made the engine do any work at all. Making the cavity of the valve 4⅞ inches wide will give $\frac{5}{32}$ of an inch inside lap, which we believe to be too much. Make the cavity 4⅞ inches wide. In order to cut off at ¾ stroke you will need 1⅛-inch lap; this will make the valve 9 inches long. Do not reduce the travel of the valve; if anything, it should be increased to 4½ inches. 2. Have you any catalogues of books for engineers? *A.*—No. Write to dealers in such books.

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25″ 28″ 32″ 36″ Upright Drills a specialty. Finely made, great capacity, quickly operated, prices low. Send for list of firms using our Drills. J. E. Snyder, Worcester, Mass.

The Holly Manufacturing Company, of Lockport, N. Y., will send, on application, their pamphlet illustrating pumping machinery and reports of duty trials.

25″ 32″ 37″ 42″ "Only Drill Press built on 'Ko-rekt' principles, even if they come from Jersey." Gould & Eberhardt, New Ark, N. J.

Steam Boilers: Their management and working on land and sea. By Jas. Peattie. Practical facts from 30 years' experience. 230 pages. Illustrated, 12mo., cloth, $2. Circulars and Catalogue of Books for engineers free. E. & F. N. Spon, 12 Cortlandt st., N.Y.

Barnard's Separator, for Separating and Removing Entrained Water from Live Steam, and Condense Water, Oil, Dirt, etc., from Exhaust Steam. Special Design for Surface Condensers. Send for circular and prices. Geo. A. Barnard, 15 Cortlandt st., New York.

De Lamater Screw Propeller Wheel, made only by The Samuel L. Moore & Sons Co., Elizabethport, N. J., who have purchased from C. H. De Lamater & Co., New York, all their patterns, books of record, gauges, etc. Location and equipment well adapted for Heavy Steamship Repairs.

H B. Roelker, 22 Cortlandt st., New York, late Sup't Delamater Iron Works, will hereafter manufacture the Delamater Screw Propeller. Propellers of same pattern and workmanship as formerly made by the Delamater Iron Works. Each designed for its special work at lowest prices. Consulting Expert and Constructing Engineer. Estimates made on machinery and on damages.

"Indicator Practice and Steam Engine Economy." By F. F. Hemenway. Contains plain directions for using the indicator, and making all required calculations from the diagram; also the principles of economy in operating steam engines and current practice in testing engines and boilers. Price $2, postpaid. Published by John Wiley & Sons, 15 Astor Place, New York.

Patent Development Company, 59 Fifth ave., New York. Incorporated 1889. Capital, $250,000. This company affords facilities for the manufacture and placing on the market desirable patented and unpatented articles of a nature calculated to come into general use. Preference given to light farming implements and useful household utensils. No fees or charges of any nature required from the owner of inventions. Hours for examination of models or drawings, from 10 to 2 o'clock.

"Practical Drawing." By J. G. A. Meyer. The above series of articles, now running in the AMERICAN MACHINIST, should be closely followed by every student. They commenced with October 23, 1886 issue, and up to and including October 10, 1889 issue, 87 articles have been so far published. Copies containing these articles sent by mail to any part of this country or Canada at 5 cents each. AMERICAN MACHINIST PUBLISHING CO., 96 Fulton st., New York.

"Modern Locomotive Construction." By J. G. A. Meyer. The above series of articles, now running in the AMERICAN MACHINIST, are attracting the attention of railway mechanics all over the world. Commencing with the June 27, 1885 issue, 101 articles have thus far appeared up to and including the October 3, 1889 issue. Copies containing these articles sent by mail to any part of the U. S. or Canada, at 5 cents each. AMERICAN MACHINIST PUBLISHING CO., 96 Fulton st., New York.

C. H. De Lamater & Co. have closed their extensive manufactory at the foot of West 13th street, New York, and have sold the Hot Air Pumping Engine and Steam Pump business to the De Lamater Iron Works (incorporated in 1889), and the Propeller Wheel business to the Samuel L. Moore & Sons Co., of Elizabethport, New Jersey.

In order to close out the remainder of the stock, offer for sale a very desirable lot of machinery, such as lathes from 15″ to 88″ swing, planing machines 48″x45″x10′, 53″x50″x12′, 17″x14″x24′, 72″x69″x24′, and various other sizes; drilling machines, slotting machines, shaping machines, boring machines, bolt-cutting machines, cutting-off machines, nut tappers, milling machines, gear cutters, emery tool grinders, portable drills, screw-cutting machines, vises, lathe and planer tools, and a variety of small tools; also traveling and jib cranes.

Punching and shearing machines for boiler makers, with a general outfit of small tools. Blacksmiths' tools, such as anvils, sledges, tongs, etc. Pattern lathes, benches, saws, screws, nails, and a general supply of small tools. Foundry cranes, cupolas and small tools. Blocks, ropes, bolts, nuts, washers, packings, pipe and fittings, iron and brass valves. Boiler iron, steel plate and boiler rivets. Bar iron and steel; also steam hammers, and two 8″x16″ and one 10″x20″ Rider cut-off engines.

MANUFACTURES

The Roanoke (Va.) Machine Works, will increase its plant.

Desky Bros. propose to build a toy factory at Muskegon, Mich.

L. C. Porter's flouring mill at Winona, Minn., was burned recently.

The Eagle Foundry Co. is building a foundry at Greensboro, N. C.

J R. Towle & Sons will build a box factory at Northwood, N. H.

E. T. Williams will build a furniture factory, 100x125 feet, at Macon, Ga.

The forge shop of the Columbus (Ohio) Bolt Works was burned recently.

Thompson & Agu contemplate enlarging their wagon factory at Camden, Ala.

The Adams Coke Oven Co., Pittsburgh, Pa., have increased their capital stock to $500,000.

The Canton (Ohio) Lock Company has been incorporated, with a capital stock of $15,000.

The Dustin & Hubbard Manufacturing Co. are building a machine shop at Fort Payne, Ala.

A large pulp mill is being built by the American Sulphide Pulp Co., at Mt. Tom Station, Mass.

Charles Chauncey will rebuild his saw-mill and cotton gin recently burned at Elkinsville, N. C.

A $50,000 stock company is being organized, to erect a shoe factory and tannery at Anderson, S. C.

The Lindell Electric Company was recently incorporated at St. Louis, Mo. Capital stock, $20,000.

The Belding Lumber Company will erect several saw-mills at and in the vicinity of Niles Ferry, Tenn.

Ground has been broken for a cotton factory at Butler, Ga. Thomas Waters organized the company.

The lumber mill and box factory of George Sanders, at Nashua, N. H., were recently destroyed by fire.

A company has been formed at Pittsburgh, Pa., to manufacture the Wilcox safety brake for inclines and elevators.

T. F. Burbank and Jule Peek are organizing a $50,000 stock company to erect a woolen mill at Cedartown, Ga.

The property of the Rockland (Maine) Brass and Iron Company has been sold to Thomas J. McDermot, of Biddeford.

The monthly sheet of the Cincinnati (Ohio) Radial Drill Co. contains an illustration of their recently improved radial drill.

A new box factory, 50x96 feet, is being built at Nashua, N. H., by George A. Sanders. It is to replace his factory recently burned.

The Goodall Worsted Company is building a yarn mill at Sanford, Maine. The mill will be 53x155 feet, two stories. It will be run by steam.

The Dorrance property at Andover, Conn., consisting chiefly of a water privilege, has been bought by Fred. Case. He will build a large paper mill.

The Goodell Manufacturing Co. has been organized in Sanford, Me., to manufacture yarns and textile fabrics. The company has a capital stock of $30,000.

The Oil Well Supply Co., Pittsburgh, Pa., finding their present works inadequate, owing to the great demand for oil tools, are putting up a new building, 40x110 feet.

The Philadelphia & Reading rail mill at Reading, Pa., has been bought by Cafrode & Saylor, of Philadelphia. The mill will be changed to make structural iron.

The Wilson-Snyder Manufacturing Company, Pittsburgh, Pa., who make engines, pumps and general machinery, are adding tools to increase the capacity of their plant.

The Western Foundry and Machine Works, Topeka, Kas., will add to their foundry department a building 20x70 feet, and to their machine department a building 25x90 feet.

The Magic Safety Bit Company has been organized and incorporated at Fairfield, Maine, with a cash capital of $10,000, to manufacture and sell the bit patented by Mr. A. F. Gerald.

The Pond Engineering Co., St. Louis, Mo., send us their 1889 catalogue of steam boilers. The catalogue is well arranged, and, in addition to the usual matter, contains information of general interest.

Montgomery & Co., New York, have issued a catalogue of what they term "Odds and Ends." It illustrates and describes a large number of small tools for the use of machinists and other artisans. It is a handy catalogue to have near by.

The proposed enlargement of Moody, Esterbrook & Anderson's shoe factory at Nashua, N. H., will increase its capacity from 1,500,000 pairs a year to between 2,500,000 and 3,000,000, the pay-roll from $300,000 to $500,000, and the number of hands from 600 to 1,000.

The plant of the Henderson Iron Company at Sharpsville, Pa., has recently passed into the hands of the Wheeler Furnace Company. The Henderson furnace has been out of blast for some time, but it is expected that the Wheeler Company will increase its capacity.

The Grant Locomotive Works have taken a contract for five Leslie's rotary steam snow shovels. There is considerable work on these snow shovels, and it is expected that, in a few weeks, the Grant works will have a very busy appearance, and may remain so up to January.

The Dearborn Elevated and Surface Electric Railroad Company, of Chicago, Ill., has been incorporated, to operate an elevated and surface street railway by electricity. Capital, $12,000,000. The incorporators are: Walter L. Sessions, Jr., H. H. C. Miller and David T. Corbin.

The Milford Shoe Co., of Milford, Mass., was incorporated last June with a paid-up capital of $200,000. They have purchased the entire plant formerly occupied by Henry & Daniels, and succeeded to their business. The plant cost $80,000, and was purchased by the Milford Company for $20,000.

The Pond Engineering Company, St. Louis, Mo., are contracting engineers for the steam plant at the new Thomson-Houston lighting station at Joliet, Ill. They will furnish and erect three one hundred horse-power boilers, one two hundred and fifty horse-power Lane & Bodley Corliss engine, Hoppes live steam purifier, Lowe heater, pump, injector, etc. The station will be complete in every detail, and equipped with the latest refinements.

At the recent election of the Joseph Dixon Crucible Co., Jersey City, N. J., the following directors were chosen by a two-thirds vote, to manage the affairs of the corporation for the ensuing year, viz.: Thomas M. Gopsill, Richard Butler, Jerome D. Gillett, Daniel T. Hoag, Alfred Porter, Charles H. Murray and John A. Walker. The directors subsequently elected Thomas M. Gopsill president of the company, and John A. Walker, the superintendent of the works, was also elected secretary.

Wharton McKnight, of the Anchor Foundry [Pittsburgh, Pa.], has a block of Bessemer steel, 10 inches by 10 inches by 7 inches, 5 inches of which has been treated by the Redeman-Tilford Steel Company, being rendered virtually drill-proof, the remaining 2 inches being soft. This is made as a specimen of the plates the Redeman-Tilford Steel Company are preparing for the cruisers of Uncle Sam. Mr. McKnight could make no impression with chisels or with ordinarily tempered drills upon the hardened portion of the block, although he tried several kinds of tool steel salt water hardened, with some of Park Bros.' special tool steel lead hardened; after an hour and a quarter's drilling he managed to penetrate three-fourths of an inch into it.—*American Manufacturer.*

The Southern Iron Company, of Nashville, Tenn., which was recently organized with a capital of $3,000,000, has just purchased the property of the Drouillard Iron Company, the consideration being $140,000 cash. The property comprises 17,000 acres of mineral and timber lands in Dickson county, equi-distant from the Cumberland river and the town of Dickson, on the Nashville, Chattanooga & St. Louis Railway, being eight miles from each point. The furnace on this property has been in almost constant use for nearly a century. It is not known whether the Southern Iron Company will erect a new furnace or use the property in supplying their other furnaces with ore and charcoal. A railroad will be built from Dickson to the property, passing through the town of Charlotte.—*The Tradesman.*

H.W. Lines, of this city, and R. L. Peck and Walter L. Cheney, of Hartford, have organized a joint stock corporation, known as The Meriden Machine Tool Co. The articles of association are printed in this issue, and they state the purposes of the organization. The concern has the rare advantage of being composed of business men and practical mechanics. All the stockholders, except Mr. Lines, will be personally identified with the factory, the benefit of which need not be pointed out. The Hartford gentlemen are young, energetic men of ability, and practical in the machine and tool business, and their modest beginning here, like all our concerns of merit, is but the harbinger of future growth, and a mark for a new industry in Meriden in days to come. Meriden needs a more diversified class of factories than any that are starting, and hence this new and unpretentious one will be welcomed. The company's works are located at 140 State street.—*Meriden* (Conn.) *Daily Republican.*

Machinists' Supplies and Iron.

NEW YORK, Nov. 9, 1889.

Iron—American Pig.—It is difficult in many cases to get prompt shipments of iron for immediate use, and furnace men are indifferent about booking orders for future delivery. We quote Northern brands, No. 1 X Foundry, $17.50 to $18.50; No. 2, $16.50 to $17 50 Southern brands, No. 1, $17.25 to $18; No. 2, $16.50 to $17.

✻WANTED✻

"Situation and Help" Advertisements only inserted under this head. Rate 30 cents a line for each insertion. About seven words make a line. Copy should be sent to reach us not later than Saturday morning for the ensuing week's issue.

Competent agents wanted to represent a meritorious & paying steam specialty. Business, AM. MACH

Wanted—Exp. machinists in our lathe chuck dep't. The Hoggson & Pettis Mfg.Co., New Haven, Ct.

Foundry foreman, 17 years' exp., desires position. General machinery preferred. BOX 37, AM. MACH.

Wanted - Four first-class men at once—tool maker, fitter, milling machine hand and lathe hand. Gisholt Machine Co., Madison, Wis.

Wanted—Position as engineer; have had charge of a steam plant for several years. Thoroughly competent. Best refs. Box 40, AMERICAN MACHINIST.

Position wanted as superintendent by one familiar with first-class engine work—Corliss specialty—and heavy machinery. C. H. T., AMERICAN MACHINIST.

Foreman and contractor wanted, who can handle men and do good work promptly. Address Steam Engine, care AMERICAN MACHINIST.

Wanted—Draftsman to make reliable set of work'g drawings of new mach'y, and blue p'ts. State compensation desired, with ref., Drawer 651, Albany, N.Y.

Machinists Wanted—Vise hands accustomed to first-class work. Steady employm't and liberal wages guaranteed. Have largely increased our plant and need more men. Niles Tool Works, Hamilton, O.

Wanted—Six good boiler makers accustomed to fitting up loco. & marine work. Steady work. Riveters or caulkers not wanted. Apply at Richmond Locomotive and Machine Works, Richmond, Va.

Wanted—Two good pattern makers on stationary engine and general pattern work. Permanent employment to the right men. State wages expected and refs. Address Erie City Iron Works, Erie, Pa.

Wanted—Young man who is a good draftsman and practical mechanic. Address, stating age, experience, references, and wages required, to P. O. Box 86, Cleveland, Ohio.

Position Wanted—By young man, machinist and tool maker; some years' exp. designing and constructing light mach'y and tools. Good draftsman, and has good tech. education. Box 45, AM. MACH.

Wanted—Six good machinists; those used to wire nail machines preferred. Wages, from $2.25 up. Location good, shop clean and healthy. Address "F.," giving age, care AMERICAN MACHINIST.

Wanted—An exp'd foundry foreman for a general class of work. Also foreman of malleable iron dep't, or a person competent to take charge of both. Permanent employment at stated salary, or will furnish plant, materials, etc., and purchase the castings by the ton. Address "Manufacturer," AM. MACHINIST.

Young man, aged 30, wishes to make a change. Is a thorough mechanic, understands machine design and mathematics. Is capable of developing methods and tools for economical production of work. Has had 5 years' experience in shop management, and bears good reputation as to personal character and mechanical ability. Address "Machine Tools," care AMERICAN MACHINIST.

✢ MISCELLANEOUS WANTS ✢

Advertisements will be inserted under this head at 35 cents per line, each insertion.

20" Lever Drill Presses, $65. S. M. York, Clevel'd, O.

Koopman's Scales for quick measurements.

Glass Triangles. F. E. Harthan, Worcester, Mass.

Just out; aluminum-steel hack-saws, hard but not brittle. Crescent Mfg. Co., Cleveland, O.

New catalogue of engineers' specialties free. Crescent Mfg. Co., Cleveland, O.

Light and fine machinery to order; Foot Lathe. Catalogue for stamp. E. O. Chase, Newark, N. J.

August C. Christensen, 24 State st., N. Y., Consulting Engineer. Designs of all kinds of Machinery.

Turned and Highly Polished Iron and Steel Shafting a specialty. Merwin McKaig, Cumberland, Md.

Complete list of our Scales and other new tools for 2c. stamp. A. T. Koopman, Chicago.

D. J. Kelsey, M. E., Designer of Automatic Machinery, 31 Insurance Building, New Haven, Conn.

Box E., Middletown, N. Y., wants good 2nd hand 50 horse-power automatic engine; also pump.

For Sale—An established mach. business, protected by valuable patents. Can be much enlarged by judicious management. C. M. W., AM. MACHINIST.

Wanted—A Root or Baker blower of small size; must be in good repair and cheap for cash. Address Ohio, Box 44, AMERICAN MACHINIST.

Engineers wanted to send their addresses and receive free a 25 cent book, "Hints and Suggestions for Steam Users." Lord & Co., P. O. Box 1262, Phila., Pa.

Wanted—To buy second-hand lathes, planers and shapers of all sizes; must be cheap and in good order. Fosdick & Plucker, 6th and Culvert Streets, Cincinnati, O.

How to remove and prevent scale in steam boilers at a cost of ten cents a week. Send postal for circular to Pittsburgh Boiler Scale Resolvent Co., Pittsburgh, Pa.

For Sale Cheap—A well-equipped machine shop, doing a thriving business in a live and growing town of 3,000 pop., in the eastern part of the new State of Washington. No opposition within 65 miles. Reason for selling, poor health. Write to Carley Bros., Colfax, Wash.

Established 1832. BRADLEY'S POWER HAMMERS
The BEST in the WORLD
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Cold Medal, Paris, 1889.
Importation Orders Promptly filled.
ALL KINDS OF Steel in Stock.

"Star" Foot Lathe Swings 9x25 in. LATHE Screw Cutting Automatic Cross Feed, etc.
Scroll Saws, Circular Saws, Lathes Mortisers. LATHE Catalogue Free of all our Machinery
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For cutting the teeth of gears; one Cutter cuts a pitch from 18 teeth to a rack inclusive.
Send for descriptive circular and price list.
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PATENTS THOMAS P. SIMPSON, Washington, D. C. No atty's fee until Patent obtained. Write for Inventor's Guide

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PUMPS
FOR ALL PURPOSES.
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Is now used by many of the largest and most carefully managed shops for all Lathe and Planer Tools, Punches, Dies, Taps, Reamers, &c.
This steel is famous for its uniformity and great endurance, and should be specified by Machinists and Tool-makers who want the best stock for their tools.
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CAN BE FORCED HOT.
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RUE'S EJECTOR,
Superior to all others for Raising and Forcing Water and other Liquids.
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Uses Warm Water, avoiding injury and facilitating the Raising of Steam.
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For the reason that if you are interested in raising water or other liquids by steam power, we wish to call your attention to the NEW PULSOMETER,
CHEAPEST & BEST STEAM PUMP IN THE MARKET. PRICES LOWER THAN ANY OTHER.
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For returning steam, condensed under pressure, automatically into the boiler, under high or low pressure.
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Vertical and Horizontal.
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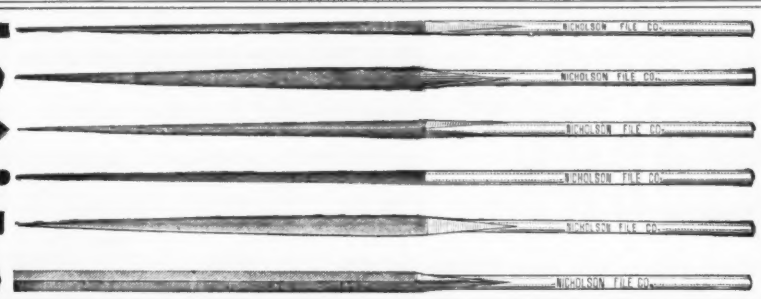

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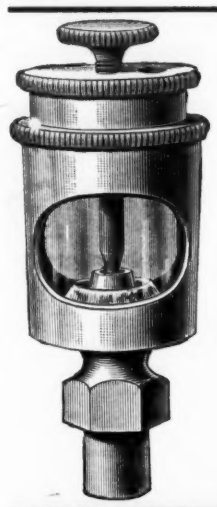

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CAMERON SELF-HARDENING
STEEL
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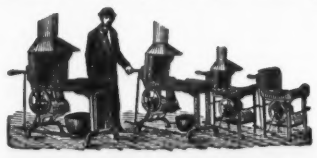

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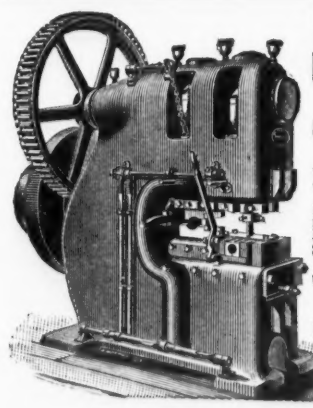

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Cheapest and Best Automatic Steam Vacuum Pump. Handling DIRTY and GRITTY LIQUIDS without Wear, Oil or Care. Simple, Economical, Efficient & Durable. Pumping Plants for Contractors, Irrigation, Water Works, Railroads, Mining & General Hydraulic Purposes. Write or call for Circulars. JOHN MASLIN & SON, SOLE MANUF'RS, 165-167 1st St., Jersey City, N. J.

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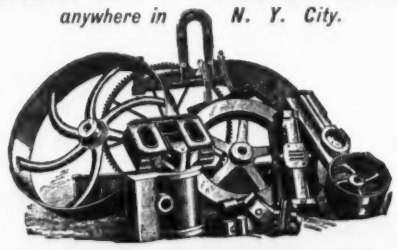

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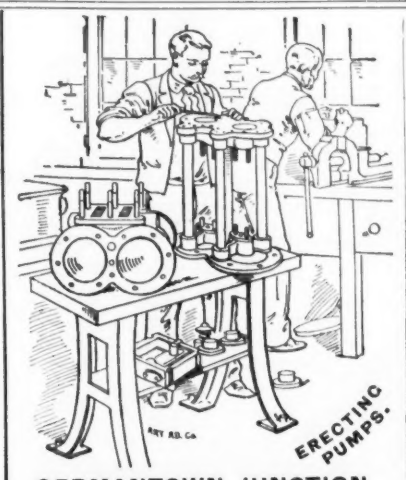

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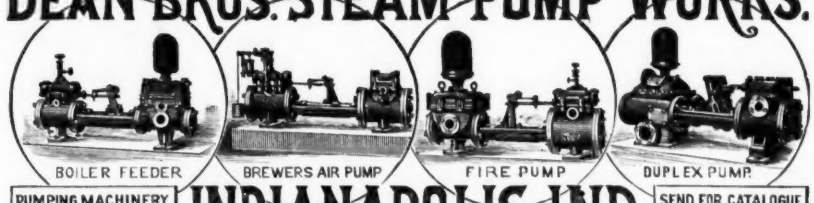

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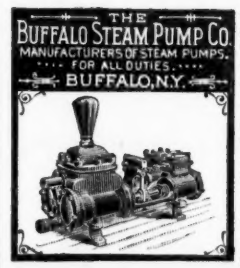

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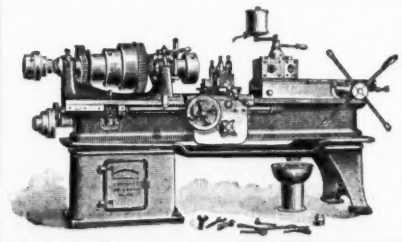

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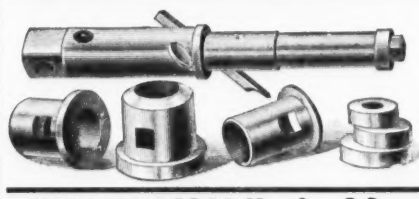

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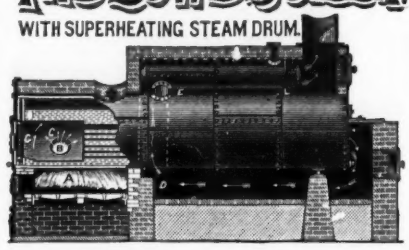

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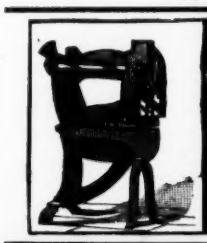

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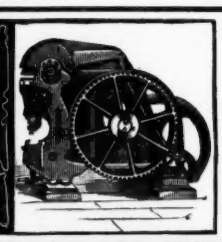

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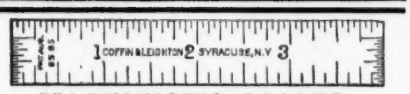

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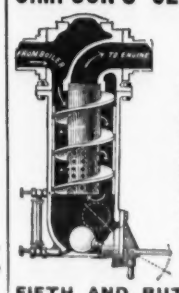

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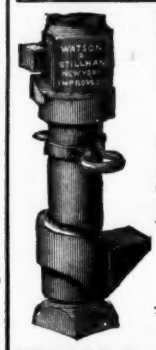

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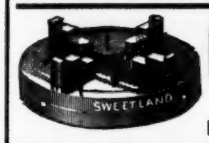

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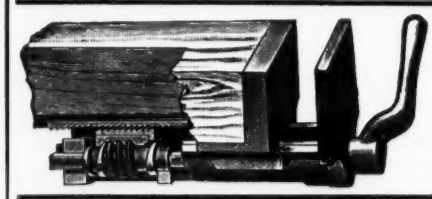

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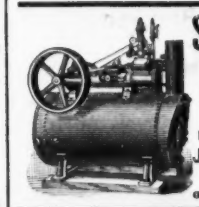

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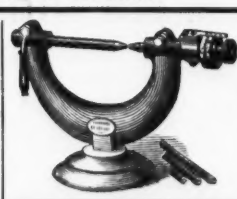

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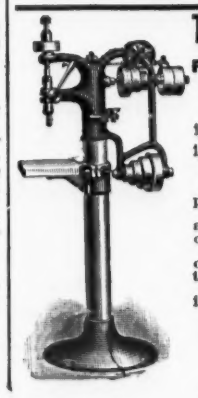

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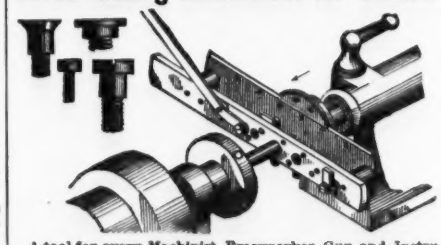

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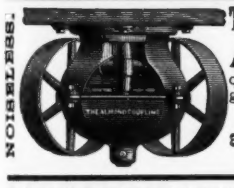

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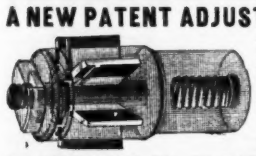

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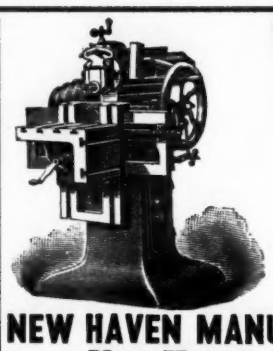

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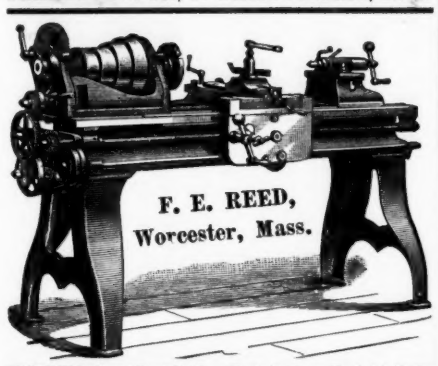

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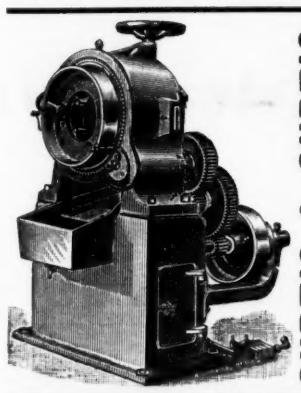

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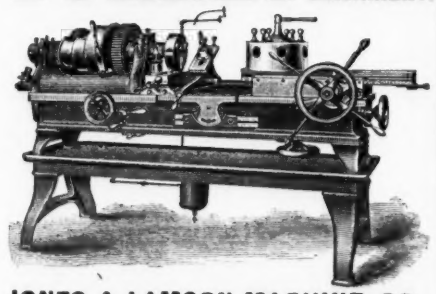

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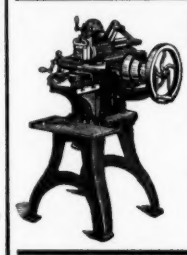

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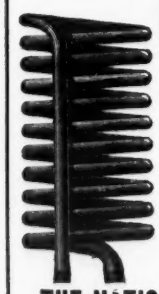

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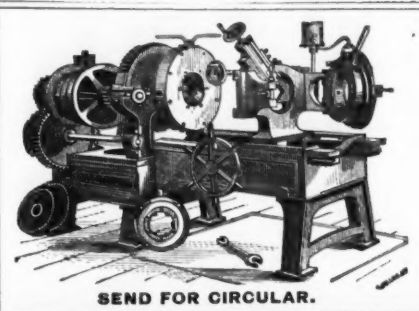

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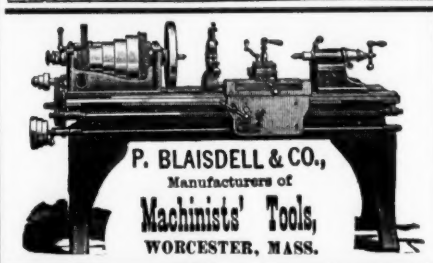

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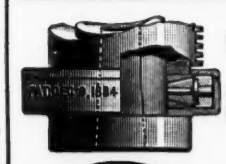

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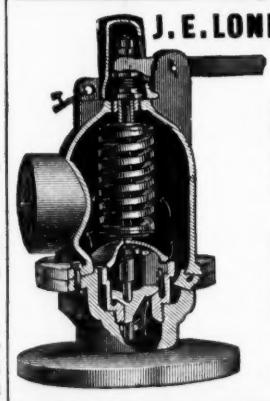

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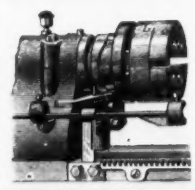

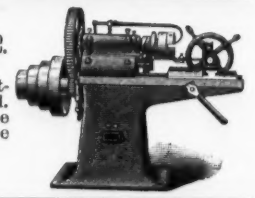

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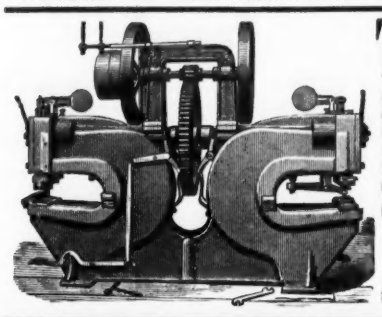

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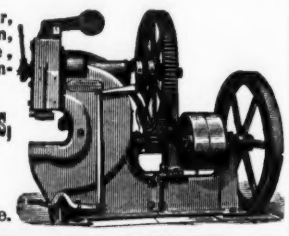

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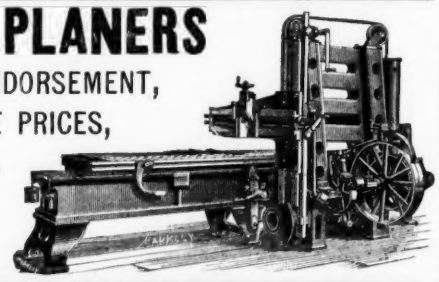

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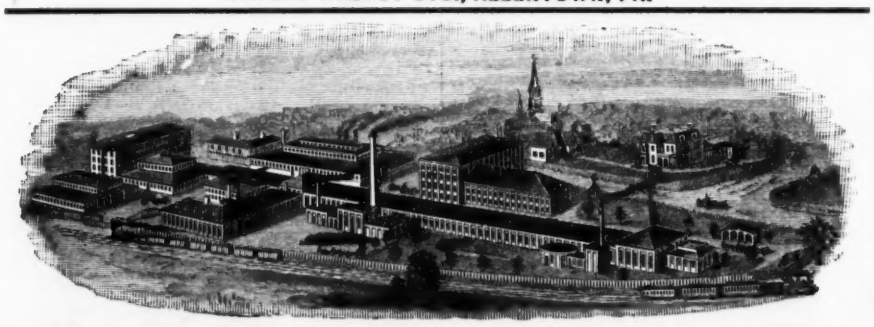

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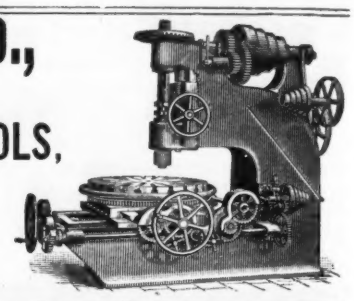

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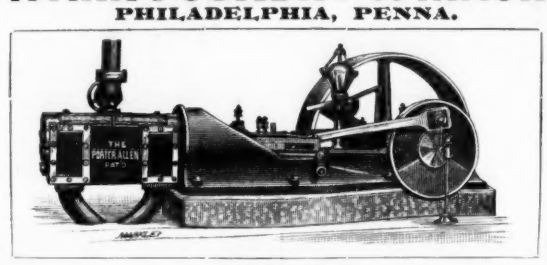

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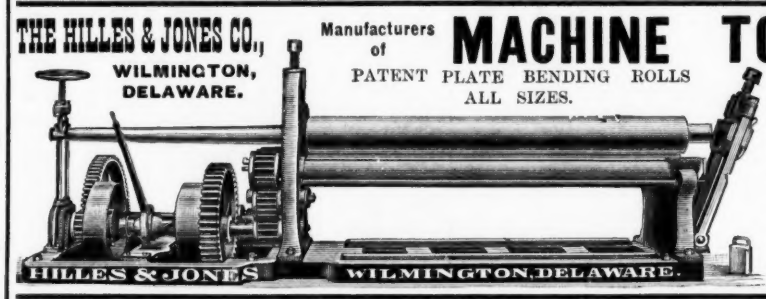

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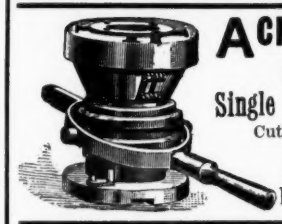

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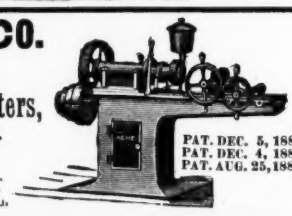

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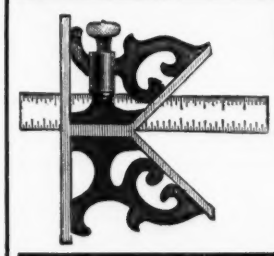

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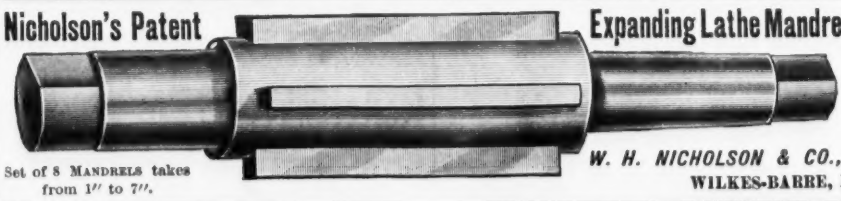

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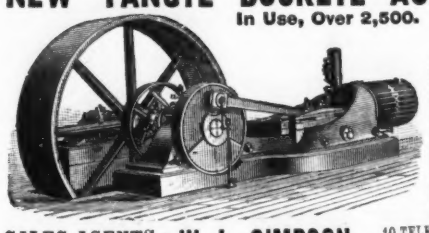

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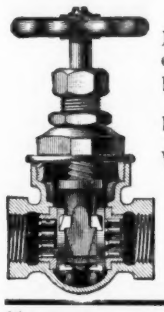

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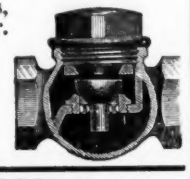

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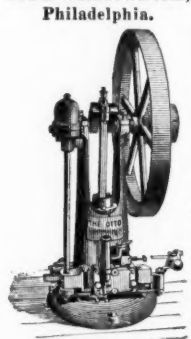

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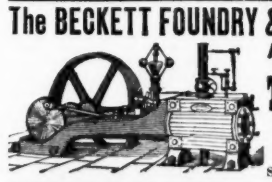

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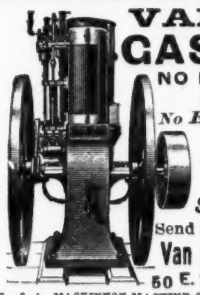

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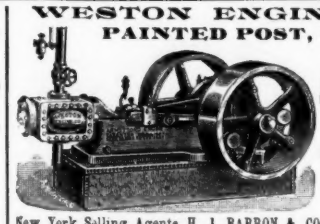

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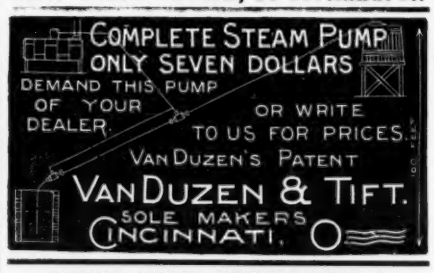

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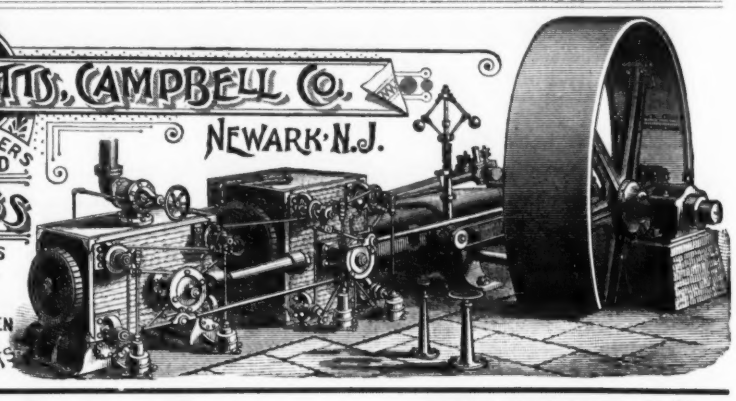

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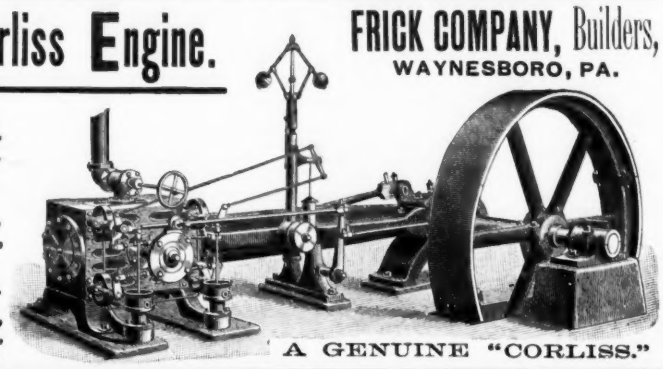

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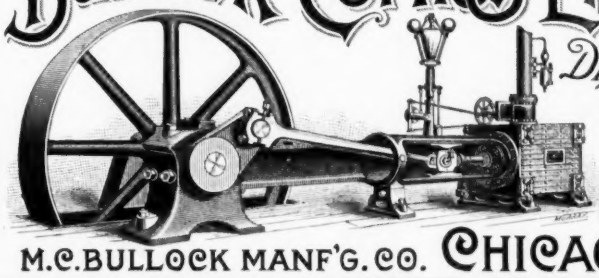

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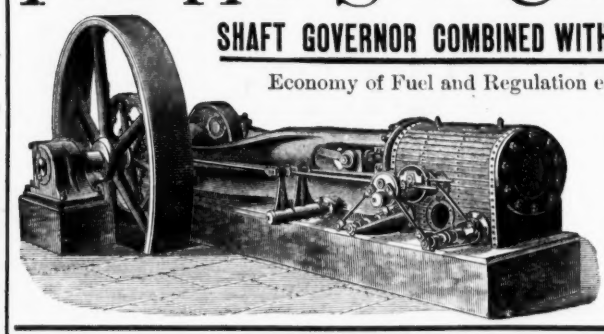

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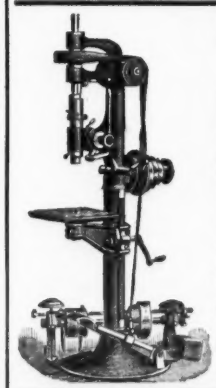

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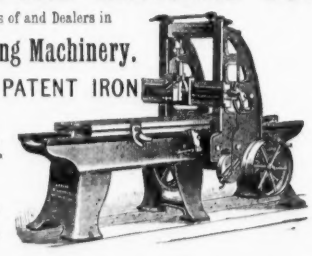

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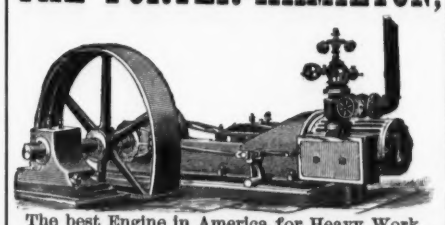

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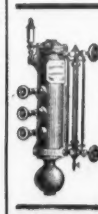

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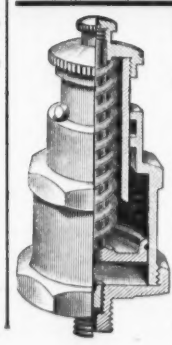

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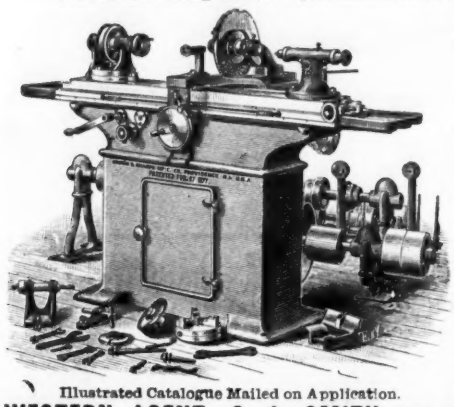

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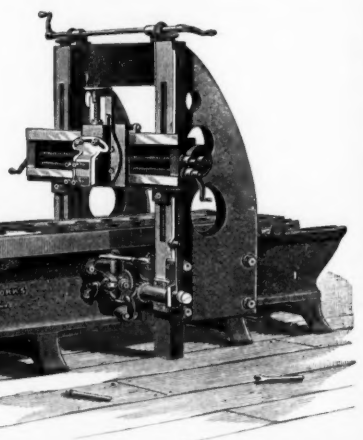

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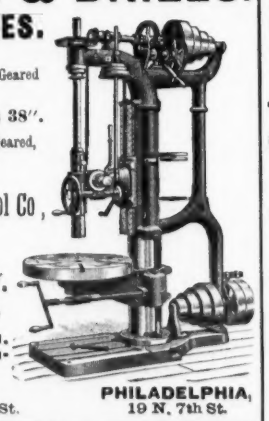

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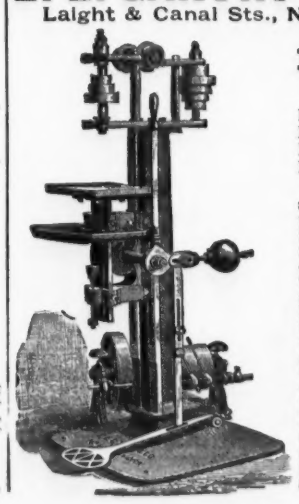

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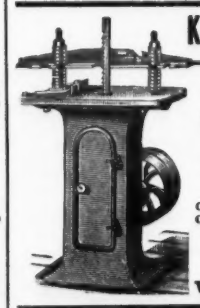

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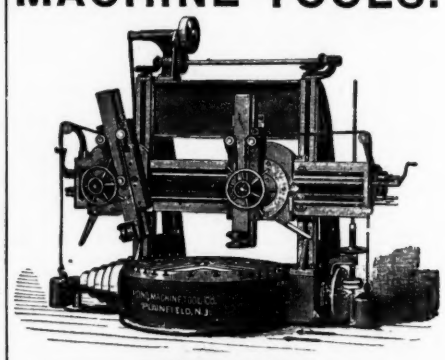

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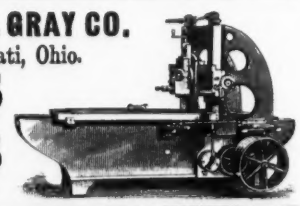

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